BALLOT VOTE DUE: August 30, 2022

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Staff is forwarding to the Commission a briefing package recommending that the Commission issue a notice of proposed rulemaking (NPR), pursuant to the Flammable Fabrics Act, to amend the Standard for the Flammability of Clothing Textiles in 16 CFR part 1610 to update and clarify equipment and procedures in the standard. The Office of the General Counsel is providing for the Commission's consideration a draft NPR for that purpose.

Please indicate your vote on the following options:

I. Approve publication of the attached notice in the *Federal Register*, as drafted.

(Signature)

The Commission

Alberta E. Mills, Secretary

Jason K. Levine, Executive Director

Daniel R. Vice, Assistant General Counsel,

Meridith L. Kelsch, Attorney, Regulatory Affairs

Proposed Rule to Amend the Standard for the

Flammability of Clothing Textiles (16 CFR part 1610)

THROUGH: Austin C. Schlick, General Counsel

Regulatory Affairs

TO:

FROM:

SUBJECT:

II. Approve publication of the attached notice in the *Federal Register*, with the following changes.

(Signature)

DATE: August 24, 2022

(Date)

(Date)

III. Do not approve publication of the attached notice in the *Federal Register*.

(Signature)	(Date)
Take other action specified below.	
(Signature)	(Date)

Attachment: Draft Federal Register notice: Standard for the Flammability of Clothing Textiles

Billing Code 6355-01-P

CONSUMER PRODUCT SAFETY COMMISSION

16 CFR Part 1610

[Docket No. CPSC-2019-0008]

Standard for the Flammability of Clothing Textiles; Notice of Proposed Rulemaking

AGENCY: Consumer Product Safety Commission.

ACTION: Notice of proposed rulemaking.

SUMMARY: The U.S. Consumer Product Safety Commission (Commission or CPSC) is proposing to amend the Standard for the Flammability of Clothing Textiles. The proposed revisions would clarify existing provisions, expand permissible equipment and materials, and update equipment requirements that are outdated. The Commission is providing an opportunity for interested parties to present written and oral comments on this notice of proposed rulemaking (NPR). Both written and oral comments will be part of the rulemaking record.

DATES: *Deadline for Written Comments:* Submit comments by [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

Deadline for Request to Present Oral Comments: Any person interested in making an oral presentation must send an e-mail indicating this intent to the Office of the Secretary at cpsc-os@cpsc.gov by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: Submit comments, identified by Docket No. CPSC-2019-0008, by any of the following methods:

Electronic Submissions: Submit electronic comments to the Federal eRulemaking Portal at: <u>https://www.regulations.gov</u>. Follow the instructions for submitting comments. CPSC typically does not accept comments submitted by electronic mail (e-mail), except as described below. CPSC encourages you to submit electronic comments by using the Federal eRulemaking Portal.

Mail/Hand Delivery/Courier Written Submissions: Submit comments by mail/hand delivery/courier to: Office of the Secretary, Consumer Product Safety Commission 4330 East West Highway, Bethesda, MD 20814; telephone: (301) 504-7479. If you wish to submit confidential business information, trade secret information, or other sensitive or protected information that you do not want to be available to the public, you may submit such comments by mail, hand delivery, or courier, or you may e-mail them to: <u>cpsc-os@cpsc.gov</u>.

Instructions: All submissions must include the agency name and docket number for this notice. CPSC may post all comments without change, including any personal identifiers, contact information, or other personal information provided, to: <u>https://www.regulations.gov</u>. Do not submit electronically: confidential business information, trade secret information, or other sensitive or protected information that you do not want to be available to the public. If you wish to submit such information, please submit it according to the instructions for mail/hand delivery/courier written submissions.

Docket: To read background documents or comments regarding this proposed rulemaking, go to: <u>https://www.regulations.gov</u>, insert docket number CPSC-2019-0008 in the "Search" box, and follow the prompts.

FOR FURTHER INFORMATION CONTACT: Paige Witzen, Project Manager, U.S. Consumer Product Safety Commission, 5 Research Place, Rockville, MD 20852; telephone (301) 987-2029; e-mail: PWitzen@cpsc.gov.

SUPPLEMENTARY INFORMATION:

I. Background

A. History of the Standard for the Flammability of Clothing Textiles

Congress enacted the Flammable Fabrics Act (FFA; 15 U.S.C. 1191-1204) in 1953, to prohibit the importation, manufacture for sale, or the sale in commerce of any fabric or article of wearing apparel that is "so highly flammable as to be dangerous when worn by individuals."¹ The FFA of 1953 required that a test, first published by the Department of Commerce as a voluntary commercial standard, then called "Flammability of Clothing Textiles, Commercial Standard 191–53" (CS 191-53), be used to determine if fabric or clothing is "so highly flammable as to be dangerous when worn by individuals." In 1975, the Commission codified CS 191-53 as the Standard for the Flammability of Clothing Textiles at 16 CFR part 1610 (Standard). 40 FR 59884 (Dec. 30, 1975).² The Commission has since amended 16 CFR part 1610 several times to clarify requirements and update outdated materials, equipment, and technologies.³

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B. The Current Standard

The purpose of the Standard is to reduce the risk of injury and death by providing a national standard for testing and rating the flammability of textiles and textile products used for clothing. 16 CFR 1610.1(a). The Standard includes test equipment, materials, and procedures for testing the flammability of clothing textiles. As a general overview,⁴ the Standard includes specifications for a flammability test apparatus, which consists of a chamber that contains an ignition mechanism, sample rack, and timing mechanism. The test procedure generally involves

⁴ See 16 CFR part 1610 for details regarding test equipment, materials, and procedures, as well as exceptions. THIS DOCUMENT HAS NOT BEEN REVIEWED OR ACCEPTED BY THE COMMISSION.

¹ Pub. L. No. 83–88, 67 Stat. 111 (June 30, 1953).

² In 1967, Congress amended the FFA to allow for rulemaking to issue flammability standards. Pub. L. No. 90–189, 67 Stat. 112 (Dec. 14, 1967). Congress transferred the authority to administer the FFA, including issuing regulations, to CPSC in 1972. 15 U.S.C. 2079(b).

³ *See, e.g.*, 59 FR 33193 (June 28, 1994) (removing the names of firms that supplied components of the test apparatus and equipment because additional firms had since entered the market); 73 FR 15636 (Mar. 25, 2008) (revising definitions and the test procedure to reduce confusion, updating test equipment and methods to reflect currently available materials, and revising burn codes to improve accuracy and consistency).

placing a specimen in the test apparatus, stringing stop thread across the top of the specimen, activating a trigger device that impinges a flame, and recording the time it takes to sever the stop thread and observations of the burn behavior of the specimen. This test is performed before and after refurbishing the specimen, which involves specified methods of dry cleaning and laundering, and must be performed on multiple specimens.

After testing, the burn time (*i.e.*, the time elapsed from ignition until the stop thread is severed) and burn behavior are used to identify appropriate test result codes (*i.e.*, burn codes) and determine the classification of the textile. Class 1 textiles exhibit normal flammability and are acceptable for use in clothing; Class 2 textiles exhibit intermediate flammability and may be used for clothing; and Class 3 textiles exhibit rapid and intense burning, are dangerously flammable, and are not permitted for clothing. The criteria for each classification differ for plain surface textile fabrics and raised surface textile fabrics.

Section 1610.40 of the Standard permits the use of alternative apparatus, procedures, or criteria for tests for guaranty purposes. The FFA states that no person will be subject to prosecution for failing to comply with flammability requirements if that person has a guaranty, meeting specific requirements, that indicates that reasonable and representative tests confirmed compliance with flammability requirements issued under the statute. 15 U.S.C. 1197. For purposes of supporting guaranties, section 1610.40(c) of the Standard states that "reasonable and representative tests" could be either the flammability tests required in the Standard or "alternate tests which utilize apparatus or procedures other than those" in the Standard. The Standard specifies that for persons or firms issuing guaranties to use an alternative apparatus or procedure, the alternative must be "as stringent as, or more stringent than" the test in the Standard, which the Commission will consider met "if, when testing identical specimens, the alternative test yields failing results as often as, or more often than," the test in the Standard.

THIS DOCUMENT HAS NOT BEEN REVIEWED OR ACCEPTED BY THE COMMISSION.

Section 1610.40 sets out conditions for using this allowance. A person or firm using the allowance "must have data or information to demonstrate that the alternative test is as stringent as, or more stringent than," the test in the Standard, and retain that information while using the alternative and for one year after. 16 CFR 1610.40(d)(1), (d)(2), (d)(3), (f). Section 1610.40 specifies that the Commission will test fabrics in accordance with the Standard and will consider any failing results evidence of non-compliance and a false guaranty. *Id.* 1610.40(e), (g).

C. History of this Rulemaking

In 2019, the Commission published a Request for Information (RFI), seeking information about the equipment and procedures in the Standard and possible ways to update those provisions to reduce testing burdens, improve clarity, and reflect current industry practices and technologies. 85 FR 16797 (Apr. 23, 2019). The RFI requested information about the clarity of the test result codes, availability and clarity of the stop thread specification, restrictions on the dry cleaning solvent, and availability of machines meeting the laundering specifications in the Standard.⁵ Based on feedback received in response to the RFI, as well as CPSC staff's testing and other information, the Commission now proposes to amend the Standard to update and clarify these provisions.⁶ For additional details, see CPSC staff's briefing package supporting this notice.⁷

⁵ The RFI also sought input on the possibility of adding spandex to the list of fabrics that are exempt from testing requirements in 16 CFR part 1610. However, comments on the RFI and additional staff research did not provide sufficient information to justify such an exemption at this time. See *Status Update: 16 CFR Part 1610 Rule Update and Consideration for Adding Spandex Fibers to the List of Currently Exempted Fibers from Testing* (Sep. 30, 2020), available at: <u>https://www.cpsc.gov/s3fs-public/StatusUpdate-</u>

 $[\]frac{16 CFRPart 1610 Rule Update and Consideration for Adding Spandex Fibers to the List of Currently Exempted Fibers - from - Testing.pdf.$

 ⁶ The Commission voted TBD-TBD to issue this notice.
 ⁷ Available at: TBD.
 THIS DOCUMENT HAS NOT BEEN

D. The Product and Risk of Injury⁸

The Standard applies to all items of clothing and fabrics intended to be used for clothing (*i.e.*, articles of wearing apparel), whether for adults or children, for daywear or nightwear,⁹ with certain listed exclusions.¹⁰

Between January 1, 2016, and December 31, 2020 (the most recent year for which data are available), there were an average of 81 deaths annually in the United States that involved ignition of clothing. An average of 2.2 of these fatalities involved ignition or melting of nightwear, and an average of 78.2 of these fatalities involved ignition or melting of other clothing. Between 2000 and 2020, the number of clothing fire deaths declined, overall. In addition, using CPSC's National Electronic Injury Surveillance System (NEISS),¹¹ staff estimates that between January 1, 2017, and December 31, 2021 (the most recent year for which data are complete), there were an average of 5,300 nonfatal injuries annually that were associated with clothing ignition treated in U.S. hospital emergency departments.

II. Statutory Requirements for Revising the Standard

The FFA specifies the requirements for the Commission to issue or amend a flammability standard. The Commission may initiate rulemaking by issuing an advance notice of proposed rulemaking (ANPR) or an NPR. 15 U.S.C. 1193(g). The Commission is initiating this rulemaking with an NPR. The FFA requires that an NPR include the text of the proposed rule, any alternatives the Commission proposes, and a preliminary regulatory analysis. *Id*. 1193(i). The preliminary regulatory analysis must include:

⁸ For detailed information about the risk of injury, see Tab A of staff's briefing package supporting this notice.
⁹ Other regulations governing the flammability of children's sleepwear, in 16 CFR parts 1615 and 1616, are more stringent than the general wearing apparel flammability standard in 16 CFR part 1610. The proposed changes discussed in this notice would not affect the children's sleepwear standards.

¹⁰ Excluded products include certain hats, gloves, footwear, interlining fabrics, plain surface fabrics meeting specified criteria, and fabrics made from certain fibers that, from years of experience, have been shown to consistently yield acceptable results when tested in accordance with the Standard. 16 CFR 1610.1(c), (d).

¹¹ NEISS uses a probability sample of about 100 hospitals in the United States that represent all U.S. hospitals with emergency departments to identify and generate national estimates of nonfatal injuries treated in emergency departments.

- a preliminary description of the potential benefits and costs of the rule, including benefits and costs that cannot be quantified, and who is likely to receive the benefits and bear the costs;
- a discussion of the reasons the Commission did not publish any standard or portion of a standard submitted in response to an ANPR as the proposed rule or part of it;
- a discussion of the reasons for the Commission's preliminary determination that efforts submitted to the Commission in response to an ANPR to develop or modify a voluntary standard would not be likely, within a reasonable period, to result in a voluntary standard that would eliminate or adequately reduce the risk of injury at issue; and
- a description of reasonable alternatives to the proposed rule, a summary of their potential costs and benefits, and a brief explanation of the reasons the Commission did not choose the alternatives.

Id.

To issue a final rule, the Commission must publish a final regulatory analysis and make certain findings. *Id.* 1193(b), (j)(1), (j)(2). At the NPR stage, the Commission makes these findings on a preliminary basis to allow the public to comment on them. The Commission must find that each regulation or amendment:

- is needed to adequately protect the public from unreasonable risk of the occurrence of fire leading to death, injury, or significant property damage;
- is reasonable, technologically practicable, and appropriate;
- is limited to fabrics, related materials, or products that present such unreasonable risks; and
- is stated in objective terms.

Id. 1193(b). In addition, to promulgate a regulation, the Commission must make the following findings and include them in the rule:

- if a voluntary standard addressing the risk of injury has been adopted and implemented, that either compliance with the voluntary standard is not likely to result in the elimination or adequate reduction of the risk or injury, or it is unlikely that there will be substantial compliance with the voluntary standard;
- that the benefits expected from the rule bear a reasonable relationship to its costs; and
- that the rule imposes the least burdensome requirement that prevents or adequately reduces the risk of injury.

Id. 1193(j)(2).

When issuing an NPR under the FFA, the Commission also must comply with section 553 of the Administrative Procedure Act (APA; 5 U.S.C. 551-559), which requires the Commission to provide notice of a rule and the opportunity for interested parties to submit written data, views, or arguments on it. 5 U.S.C. 553(c); 15 U.S.C. 1193(d). In addition, the FFA requires the Commission to provide interested parties with an opportunity to make oral presentations of data, views, or arguments. *Id.* 1193(d).

III. Description of and Basis for the Proposed Revisions

- A. Test Result Codes¹²
 - 1. Current Requirements

As described above, the burn time and burn behavior of tested specimens are used to determine the classification of a textile, and classifications determine whether the fabric may be used for clothing. Section 1610.8 of the Standard lists test result codes (*i.e.*, burn codes) that are used to record burn time and burn behavior results and help determine the appropriate classification.¹³ The burn codes and classification criteria are different for plain and raised

¹² For additional information regarding burn codes and the proposed revisions to them, see Tab B of staff's briefing package supporting this notice.

¹³ Criteria for classifications are provided in Table 1 to section 1610.4, and in section 1610.7. Because multiple specimens must be tested under the Standard, both before and after refurbishing, burn codes and classifications are based on the results of multiple tested specimens. The Standard specifies how to determine appropriate burn codes

surface textile fabrics. Section 1610.2(l) and (k) define "plain surface textile fabrics" and "raised surface textile fabrics." In general, plain surface textile fabrics do not have intentionally raised fiber or yarn surfaces, whereas, raised surface textile fabrics have intentionally raised fiber or yarn surfaces and consist of the base of the fabric, which is the fabric's structure, and the surface fibers that are raised from the base. Common examples of raised surface textile fabrics include velvet or terry cloth.

For plain surface textile fabrics, classification is based primarily on burn times. The Standard provides three possible burn codes for plain surface textile fabrics:

- DNI (did not ignite);
- IBE (ignited, but extinguished); and

Fabrics that yield DNI or IBE burn codes have no recordable burn time and are considered Class 1 fabrics. Plain surface textile fabrics with a burn time of 3.5 seconds or more are Class 1; those with a burn time of less than 3.5 seconds are Class 3; and there is no Class 2 option for plain surface fabrics.

For raised surface textile fabrics, classification is based on burn time and the intensity of the surface burning. Burn behaviors for raised surface textile fabrics fall into two general categories of intensity—surface flashes and base burns—and each category has specific burn codes associated with it. As described above, raised surface textile fabrics consist of a base and intentionally raised surface fibers. Burn behavior that involves only surface fibers is called surface flash, whereas, burn behavior that burns through the base is called a base burn, which involves the base fabric igniting or fusing. Both burn time and burn behavior are relevant to classification of these fabrics because a rapid surface flash that quickly breaks the stop thread but

does not burn through the base of the fabric is not considered dangerously flammable; it is the combination of burning rapidly and through the base that results in a dangerously flammable fabric.

The Standard provides eight possible burn codes for raised surface textile fabrics:

- SF uc (surface flash under the stop thread);
- SF pw (surface flash part way, meaning it did not reach the stop thread);
- SF poi (surface flash at the point of impingement only);
- _._ sec. (indicating the burn time);
- _____ SF only (surface flash with a burn time);
- _._ SFBB (surface flash with a base burn starting somewhere other than the point of impingement);
- ____SFBB poi (surface flash with base burn starting at the point of impingement); and
- ____ SFBB poi* (surface flash with base burn where the base burn possibly started at the point of impingement, but testing was unable to make an absolute determination of the origin of the base burn).

Burn codes SF uc, SF pw, SF poi, and _._ SF only apply when there is a surface flash and no base burn. Burn codes SFBB, SFBB poi, and SFBB poi* apply when the surface fiber and the base of the fabric are involved in the burning behavior (*i.e.*, both surface flash and base burn occur). Burn code _._ sec. provides only the burn time, with no indication of burning behavior.

Raised surface textile fabrics are Class 1 if they either have a burn time greater than 7.0 seconds or they have a burn time of 0-7 seconds with no base burns (*i.e.*, the fabric exhibits only surface flash and no base burn). These fabrics are Class 2 if they have a burn time of 4 to 7 seconds (inclusive) and exhibit a base burn. These fabrics are Class 3 if they have a burn time of less than 4.0 seconds and exhibit a base burn.

2. Proposed Amendments and Rationale

The Commission proposes to update the burn code provisions in the Standard for raised surface textile fabrics to consolidate redundant codes, eliminate unnecessary and unclear codes, and to improve clarity. In response to the RFI, the Commission received several comments indicating that burn code information for raised surface textile fabrics is unclear. Because the burn codes help determine whether a fabric is permissible for use in clothing, a lack of clarity in these provisions could lead to misclassifications, which could impact consumer safety.

First, the Commission proposes several revisions to Table 1 to section 1610.4 to clarify the existing criteria for classifications of raised surface textile fabrics. In this table, the Commission proposes to replace the wording "with no base burns (SFBB)" in the Class 1 description with "with no SFBB burn code." As the Class 1 description for raised surface fabrics in this table indicates, a fabric falls in this class only if it either has a longer burn time (more than 7 seconds) or if it exhibits rapid surface flash only, and no base burns. As explained above, there are three burn codes that indicate that a base burn occurred—SFBB, SFBB poi, and SFBB poi*. SFBB applies when the base burn occurs as a result of the surface flash, rather than from the point of impingement of the burner, whereas SFBB poi and SFBB poi* only have a base burn due to the flame that impinges on the fabric, not from the intensity of the surface of the fabric itself burning. As such, only fabrics with burn code SFBB, and not SFBB poi and SFBB poi*, are excluded from being Class 1. The proposed revision would retain this criterion, while clarifying the specific burn code—SFBB—being referenced.

Similarly, the Commission proposes to add a note to Table 1 to section 1610.4, stating that burn codes SFBB poi and SFBB poi* are not considered a base burn for purposes of determining Class 2 and 3 fabrics. Class 2 and 3 descriptions for raised surface textile fabrics in this table specify that fabrics in these classes exhibit base burns (SFBB). Like above, only fabrics with a burn code of SFBB, and not SFBB poi and SFBB poi*, have a base burn that occurs as a

result of the surface flash rather than from the point of impingement of the burner. Although the table already references burn code SFBB for the Class 2 and 3 descriptions, the added note will make clear that SFBB refers only to that specific code, and not the other two base burn codes.

The Commission also proposes to add the classification names—Normal Flammability, Intermediate Flammability, and Rapid and Intense Burning—to the descriptions of raised surface textile classifications in the table. This addition is both for clarity and to highlight that, although both Class 1 and 2 fabrics are permissible for use in clothing, Class 2 fabrics are more flammable, which indicates that caution should be taken when using them.

Second, consistent with the clarification above in section 1610.4, the Commission proposes to revise the definition of "base burn" in section 1610.2(a) to clarify that base burns are used to establish Class 2 and 3 (not just Class 3) and to reference burn code SFBB for clarity.

Third, and also consistent with the changes above, the Commission proposes to revise the description of Class 2 for raised surface textile fabrics in section 1610.4(b)(2) to add the clarification that "base fabric starts burning at places other than the point of impingement as a result of the surface flash (test results code SFBB)."

Fourth, the Commission proposes to amend the provisions on raised surface textile fabrics in section 1610.7(b)(3) and (b)(4), which describes classification criteria in detail. The Commission proposes to add "(SFBB)" anywhere that the words "base burn" appear to make clear what burn code is being referenced, consistent with the revision in Table 1 to section 1610.4.

Fifth, the Commission proposes to revise section 1610.8, which lists the burn codes and requirements relevant to them, to streamline the codes by consolidating similar codes and removing unnecessary and confusing codes. The Commission proposes to combine burn codes SF uc, SF pw, and SF poi into a single new burn code, SF ntr (no time recorded, does not break stop thread). The three existing codes all describe burning behavior that does not have enough

intensity to break the stop thread and, accordingly, have no burn time and all result in a fabric being Class 1. Because the purpose of burn codes is to determine the classification of fabrics, it is unnecessary to have all three of these codes; instead, a single code, indicating that there was no burn time recorded, is sufficient and clearer.

Similarly, the Commission proposes to remove from the list of raised surface textile fabric burn codes in section 1610.8, the code that lists only a burn time (_._ sec.). Because burn time, alone, generally does not determine the classification of raised surface textile fabrics, this code does not help identify the appropriate classification, is confusing, and may result in misclassification.

Finally, the Commission proposes to amend the times provided in the Standard so they all include one decimal place. Currently, some references to time use one decimal place (*e.g.*, 7.0 seconds) and others use no decimal place (*e.g.*, 4 seconds). For consistency, the Commission proposes to include a single decimal place, without altering the times specified in the Standard.

None of these proposed changes would alter the testing requirements, classification criteria, or classification results under the Standard. Rather, they clarify existing requirements and consolidate codes to streamline the provisions. The Commission requests comments on each of these proposed revisions and, in particular, on whether they improve clarity, as intended.

B. Stop Thread¹⁴

1. Current Requirements

As discussed above, the test apparatus required for flammability testing includes, as part of the necessary components, stop thread, which is used to determine burn time. Section 1610.2(p) includes a definition of "stop thread," and section 1610.5(a)(2)(ii) specifies the test

apparatus and materials that must be used for flammability testing, both of which state that the stop thread must be "No. 50, white, mercerized, 100% cotton sewing thread."

2. Proposed Amendments and Rationale

CPSC has a supply of the required thread for testing. It is a 3-ply cotton thread. However, "No. 50" is not currently a common or clear method of describing thread. Lack of clarity or availability regarding the stop thread in the Standard potentially introduces variability in test results, depending on the thread testing laboratories use. This is problematic because the stop thread is used to determine burn time, which is used to determine the classification of a fabric and whether it is acceptable for use in clothing. The Standard needs to provide clear reference to a thread that is currently available on the market so that testing laboratories can acquire the necessary thread and use it to obtain consistent test results and classifications.

To identify a stop thread description that is available on the market and comparable to the current thread specified in the Standard, CPSC staff assessed the thread supply they currently use to test under the Standard, assessed an alternative thread that is marketed as complying with the Standard, considered threads required in other clothing flammability standards, and conducted testing of several threads. Currently, the industry (including internationally) commonly uses the Tex system to define thread size. "Tex" is defined as the weight, in grams, of 1,000 meters of yarn and is determined by measuring and weighing cotton threads and calculating linear density. Because of the wide recognition and use of the Tex system, staff considered the Tex size of the various stop threads assessed. For a detailed explanation of how CPSC staff determined the Tex sizes of these threads, see the briefing package staff prepared following the RFI.¹⁵

¹⁵ Tab B of staff's status update briefing package, "Status Update: 16 CFR Part 1610 Rule Update and Consideration for Adding Spandex Fibers to the List of Currently Exempted Fibers from Testing," Sep. 30, 2020, available at: <u>https://www.cpsc.gov/s3fs-public/StatusUpdate-</u> <u>16CFRPart1610RuleUpdateandConsiderationforAddingSpandexFiberstotheListofCurrentlyExemptedFibers-from-Testing.pdf.</u> THIS DOCUMENT HAS NOT BEEN REVIEWED OR ACCEPTED BY THE COMMISSION.

Staff determined that the current thread supply CPSC uses to test under the Standard has a Tex size of 36. CPSC staff also assessed a commercially available thread (Item Code 1502002, CFR1610, #50 mercerized cotton thread, lot 12308) that is marketed as complying with the Standard. Although CPSC does not use this thread, some commercial laboratories and manufacturers use this thread when testing to the Standard. Staff determined that this thread has a Tex size of 44. Staff also considered the stop thread required in the Canadian General Standards Board's standard, CAN/CGSB-4.2 No. 27.5, *Textile Test Method Flame Resistance -45° Angle Test – One Second Flame Impingement*. This stop thread specification is similar to the Standard and is described as R 35 Tex/3 (No.50, 3-ply), mercerized cotton, indicating a Tex size of 35.¹⁶ Based on these assessments, the thread CPSC currently uses, and potentially comparable threads on the market, have Tex sizes ranging from 35 to 44.

Staff conducted a thread comparison study to determine whether differences in threads, such as fiber type and size (linear density), had a significant effect on burn times and flammability classifications under the Standard, and to identify the range of Tex sizes that yield flammability results comparable to the current Standard. Because the purpose of updating the stop thread specification is to improve clarity about the thread required and ensure there is such a thread available on the market, and not to alter the results under the Standard, staff aimed to identify Tex sizes that would yield flammability results comparable to those using the thread currently specified in the Standard. This section provides information about the comparison study and results.

Staff tested five threads with varying Tex sizes, as indicated in Table 1.

Table 1. Thread descriptions.							
Thread	Description	Tex (g/1000 meters)					
А	Thread CPSC uses to test to the Standard	36					
В	Commercially available thread, sold as meeting the Standard	44					

Table 1: Thread descriptions.

¹⁶ Staff also considered the stop thread required in ASTM International's standard, ASTM D1230-17, *Standard Test Method for Flammability of Apparel Textiles*. However, this standard describes the thread as "Cotton Sewing Thread, No. 50, mercerized" and, therefore, does not provide any further detail than the Standard. THIS DOCUMENT HAS NOT BEEN CLEARED FOR PUBLIC RELEASE UNDER CPSA 6(b)(1). REVIEWED OR ACCEPTED BY THE COMMISSION.

С	Polyester core spun thread	87
D	Spun polyester thread	24
Е	Cotton thread	37

Threads A, B, and E were cotton, and Threads C and D were polyester and had more divergent Tex sizes than the cotton threads. Staff used two plain surface cotton fabrics for testing—cotton organdy (Fabric 1) and cotton batiste (Fabric 2)—each with a fabric weight of 2.06 oz/yd². Staff selected these fabrics for testing because they have burn times exceeding the 3.5-second burn time limit for plain surface textile fabrics in the Standard, had sufficient burn times (between 4 and 7 seconds) to yield a range of measurements for comparison, and did not produce many test result codes of DNI or IBE. Staff tested 30 specimens for each combination of thread and fabric.



Figures 1 and 2 provide the results of staff's testing.¹⁷

Figure 1: Burn times for Fabric 1 and Threads A through E.

¹⁷ Specimen results of DNI or IBE were excluded since these did not provide a burn time. These were excluded because this testing was designed to evaluate how sensitive the burn time measurements are to the properties of a stop thread.

THIS DOCUMENT HAS NOT BEEN REVIEWED OR ACCEPTED BY THE COMMISSION.



Figure 2: Burn times for Fabric 2 and Threads A through E.

As these figures show, the burn times for all of the thread options for each fabric were very similar. As explained above, for plain surface textile fabrics, classification depends on whether the burn time is 3.5 seconds or more, or shorter than that. For both fabrics, and all threads, the burn times were well above this 3.5-second threshold, indicating that all of the results were Class 1 and that any of the alternative threads would yield classifications consistent with the current Standard. In addition, because the burn times were all well above the 3.5-second threshold, slight variations in burn times across thread options would not alter the classifications. Moreover, there was little variation in the burn times of the different threads, with the median burn time for all threads being within 0.4 seconds for Fabric 1 and 0.3 seconds for Fabric 2. For comparison, the variability in burn times from specimen to specimen within the same fabric and thread type was wider, at about 1.0 second of variation between the slowest and fastest burn times. These results show that any of these alternative threads and Tex sizes would not result in changes in a fabric's classification when compared to the current Standard.

Based on staff's assessments and testing, the Commission proposes to amend the stop thread description in the Standard from "No. 50, white, mercerized, 100% cotton sewing thread," to state that it must consist of a spool of "3-ply, white, mercerized, 100% cotton sewing thread, with a Tex size of 35 to 45 Tex." This amendment would remove the reference to "No. 50" since the meaning of this is no longer clear, and it would add to the description that the thread is "3ply" because this is consistent with thread that complies with the current Standard. This would also maintain the requirement that the thread be "white, mercerized, 100% cotton sewing thread," as this maintains consistency with the current Standard and does not require clarification or updates due to product availability. In addition, it is preferable to continue to require cotton for the stop thread because some polyester threads are designed to be flame resistant, making cotton thread more appropriate for flammability testing.

The Commission proposes to add to the description that the range of permissible Tex sizes is 35 to 45. Staff's test results indicate that a stop thread description that allows a range of acceptable Tex sizes would yield flammability results that are consistent across that range and in line with the results obtained using the stop thread in the current Standard. Because of the wide recognition and use of the Tex system, specifying a Tex size for the stop thread in the Standard would allow testing laboratories to purchase compliant thread and obtain repeatable and reliable test results. Allowing a range of Tex sizes, instead of specifying a specific Tex size, would give testing laboratories greater flexibility in identifying and obtaining stop threads that comply with the Standard, while retaining consistent burn times and flammability classifications.

The proposed range reflects the array of Tex sizes for the three cotton threads that yielded burn times that were consistent with the current Standard (Thread A with Tex size 36, Thread B with Tex size 44, and Thread E with Tex size 37). As such, the proposed revision would allow testing laboratories to use the thread CPSC currently uses (Thread A) and the thread currently marketed as complying with the Standard (Thread B), and it would also allow the use of thread

that complies with the Canadian standard, which specifies a Tex size of 35. Although Threads C and D also yielded comparable burn times, these two threads were polyester, which is potentially problematic because some polyester threads are designed to be flame resistant, and they had much higher and lower Tex sizes (87 and 24, respectively). Therefore, the Commission is not proposing to include these Tex size within the permissible range.

The Commission seeks comments on these proposed revisions and the justifications for them. In particular, the Commission seeks comments on the use of Tex sizes; whether a range of Tex sizes is appropriate, rather than a specific size; whether the range should be limited to those of cotton thread or include the Tex sizes of polyester or other thread; and the range of sizes that should be permissible and why.

C. Refurbishing¹⁸

1. Current Requirements and Need for Amendments

The Standard requires that flammability testing be performed on samples in their original state and again after refurbishing. 16 CFR 1610.3, 1610.6. The Standard defines "refurbishing" as "dry cleaning and laundering in accordance with § 1610.6." *Id.* 1610.2(m). After testing samples in their original state, they must be dry cleaned following the procedures in section 1610.6(b)(1)(i), and then laundered (*i.e.*, washed and dried) following the procedures in section 1610.6(b)(1)(ii), before testing again. The purpose of the refurbishing requirements is to remove any non-durable or water-soluble treatments or finishes that are on the fabric that may affect the flammability of the fabric. These requirements are not meant to replicate how consumers would

care for or use the garment. The specific requirements for dry cleaning and laundering, as well as the need for updating these provisions, are discussed below.

a. Dry Cleaning

The Standard defines "dry cleaning" as "the cleaning of samples in a commercial dry cleaning machine under the conditions described in § 1610.6." *Id.* 1610.2(c). Section 1610.6 specifies that samples must be dry cleaned in a commercial dry cleaning machine using the solvent "perchloroethylene, commercial grade," and it provides specific parameters regarding detergent class, cleaning time, extraction time, drying temperature, drying time, and cool down/deodorization time. *Id.* 1610.6(b)(1)(i). Likewise, the requirements regarding the test apparatus and materials specify that the dry cleaning solvent must be "perchloroethylene, commercial dry cleaning machine must be capable of a complete automatic dry-to-dry cycle using perchloroethylene solvent. *Id.* 1610.5(b)(6), (b)(7).

In recent years, there have been increasing restrictions on the use of perchloroethylene in dry cleaning. In 2007, California adopted regulations that took incremental steps to phase out the use of perchloroethylene in the dry cleaning industry over time, and require that, by January 1, 2023, existing facilities remove all perchloroethylene dry cleaning machines from service.¹⁹ In addition, the U.S. Environmental Protection Agency has announced that it is considering steps to address the risks associated with perchloroethylene, including potentially regulating, limiting, or prohibiting production or use of the chemical.²⁰ With increasing limitations on the use of perchloroethylene in dry cleaning, the Standard needs to be updated to include an alternative dry cleaning specification so that testing laboratories that cannot use perchloroethylene can conduct compliant testing and obtain consistent, reliable, and accurate test results and classifications.

 https://govt.westlaw.com/calregs/Document/I3065E480D60811DE88AEDDE29ED1DC0A?viewType=FullText&or

 iginationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default).

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 See EPA Releases Final Chemical Risk Evaluation for Perchloroethylene (Dec. 14, 2020), available at:

 https://www.epa.gov/chemicals-under-tsca/epa-releases-final-chemical-risk-evaluation-perchloroethylene.

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¹⁹ See 17 CA ADC § 93109, available at:

b. Laundering

The Standard defines "laundering" as "washing with an aqueous detergent solution and includes rinsing, extraction and tumble drying as described in § 1610.6." 16 CFR 1610.2(i). Section 1610.6 specifies that, for laundering, a sample be washed and dried one time in accordance with sections 8.2.2, 8.2.3, and 8.3.1(A) of AATCC Test Method 124-2006, *Appearance of Fabrics after Repeated Home Laundering* (TM 124-2006), which is incorporated by reference into the regulations in section 1610.6(b)(1)(iii). Sections 8.2.2 and 8.2.3 of TM 124-2006 address washing requirements, and section 8.3.1(A) addresses drying.

For washing, the Standard requires the use of specific washing procedures (by referencing sections 8.2.2 and 8.2.3 of TM 124-2006); the use of washing machines that meet criteria for wash temperature (by referencing Table II, provision (IV) in TM 124-2006) and water level, agitator speed, washing time, spin speed, and final spin cycle (by referencing Table III, provisions for "Normal/Cotton Sturdy" in TM 124-2006); and maximum wash loads and contents. For drying, the Standard requires the test method described in TM 124-2006 for Tumble Dry (section 8.3.1(A)), with the use of machines that meet specified exhaust temperatures and cool down temperatures (by referencing Table IV, provisions for "Durable Press" in TM 124-2006).

Washing machines have changed substantially over the past 15 years to reduce water use and improve energy efficiency. One key element of washing machines that has evolved is agitation speed. Currently, the Standard requires the use of a washing machine with an agitation speed of 179 ± 2 strokes per minute (spm) (by referencing Table III, provisions for "Normal/Cotton Sturdy" in TM 124-2006). However, washing machines available on the market are no longer able to meet this requirement because they have reduced agitation speeds. Although CPSC still has washing machines that meet the required agitation speed, when these machines reach the end of their useful lives, CPSC will not be able to replace them with

machines that comply with the Standard. Likewise, CPSC expects that many washing machines that testing laboratories use to test for conformance with the Standard have reached, or soon will reach, the end of their useful lives, at which point, the labs will be unable to obtain the machines necessary to test to the Standard. As such, the Standard needs to be updated to include washing machine specifications that can be met by machines that are available on the market, and yield consistent, reliable, and accurate test results and classifications.

Unlike washing machines, there has been little change in the design of dryers in recent years, and dryers that meet the requirements in the Standard are still available on the market. Nevertheless, the Commission proposes to update the specifications for dryers in the Standard to align with the necessary updates for washing machines, for the reasons discussed below.

2. Comparison Study

Staff considered several options to update the dry cleaning and laundering specifications in the Standard and conducted comparison testing to determine whether these options would yield flammability results comparable to the current Standard. Staff sought to identify options that would not alter the flammability results of fabrics because the Standard has a long history and has been effective at addressing clothing flammability. As such, staff aimed to identify alternatives that would provide a comparable level of consumer safety, by providing comparable flammability classifications. In addition, alternatives that provide flammability results comparable to the Standard, reduce the costs associated with these updates because they would not change whether fabrics subject to the Standard are permissible for use in clothing. Finally, staff sought to identify comparable alternatives because the purpose of these amendments is to update outdated equipment and methods, not to alter the classifications of fabrics tested under the Standard.

This section provides information about the comparison study and results; for additional information, see Tabs D and E of staff's briefing package supporting this NPR.

a. Options

i. Dry Cleaning

Staff considered several dry cleaning solvents as alternatives to perchloroethylene. Staff considered hydrocarbon solvent because it is becoming the most commonly used alternative to perchloroethylene in the dry cleaning industry; it has a long history of use; it is low in cost; and it is more widely available than many other alternatives. Staff also considered silicone and butylal solvents because they are also widely available. Staff did not consider carbon dioxide dry cleaning because it is more expensive than other options and is not widely available. Staff also did not consider professional wet cleaning because it would not accomplish the purpose of the dry cleaning requirement in the Standard. The purpose of the refurbishing requirements in the Standard is to remove finishes that may affect the flammability of a fabric, and both dry cleaning and laundering are necessary for that purpose. Because fabrics are already exposed to waterbased cleaning under the separate laundering requirements in the Standard, water-soluble finishes would be removed by that process, and professional wet cleaning would not provide additional finishing removal. As such, a non-water-based dry cleaning method, like the one currently in the Standard, is appropriate. Based on these assessments, staff tested three potential dry cleaning solvent options—hydrocarbon, silicone, and butylal—as part of the comparison study.

In selecting an alternative dry cleaning solvent for the Standard, it is not sufficient to change the solvent alone; the parameters surrounding the dry cleaning procedure need to be adjusted, as well, because of the nature of different solvent systems, dry cleaning processes, and equipment requirements. As such, in assessing alternative procedures, staff selected an appropriate detergent class, cleaning time, extraction time, cooling time, drying time, and drying temperature, for each alternative solvent, based on typical procedures used for that solvent system. For all of the options, samples were dry cleaned in a commercial dry cleaning machine at

80 percent of the machine's capacity.²¹ The parameters staff used for the comparison study are in Table 2.

Solvent	Perchloroethylene	Hydrocarbon	Silicone	Butylal
Detergent Class	Cationic	Cationic	Anionic	Cationic
Cleaning Time	10-15 minutes	20-25 minutes	14-17 minutes	2 mins (bath 1) 11 minutes (bath 2) (13 minutes total)
Extraction Time	3 minutes	4 minutes	6 minutes	5 minutes (bath 1) 5 minutes (bath 2) (10 minutes total)
Drying	60-66°C (140-	60-66°C (140-	70°C (158°F)	66-71°C (150-
Temperature	150°F)	150°F)	~ /	160°F)
Drying Time	18-20 minutes	20-25 minutes	18-20 minutes	40 minutes
Cool Down/ Deodorization	5 minutes	5 minutes	5 minutes	4 minutes

Table 2: Dry cleaning procedures used in comparison study.

ii. Laundering

Staff also considered several options as alternatives to the laundering specifications in TM 124-2006. Because agitation speed is the primary element of the current specification that can no longer be met by machines on the market, one alternative staff considered was requiring the continued use of the laundering procedures in TM 124-2006, but allowing a lower agitation speed.²² Staff considered this option because it is the alternative most similar to the current Standard—with all of the washing parameters remaining the same except for agitation speed—that washing machines on the market can meet. When comparison testing this option, the agitation speed was the only washing parameter changed from the current Standard, and the drying procedures remained the same as the current Standard.

²¹ Consistent with section 1610.6(b)(1)(i)(B), staff used 80 percent wool and 20 percent cotton ballast, in addition to the sample, to achieve 80 percent of the machine's capacity.

²² Agitation speed alone is not a measure of how rough a wash cycle is on textiles. Rather, agitation speed and stroke length need to be considered in combination when comparing washing parameters. Stroke length is a measurement of the degrees of rotation of the agitator. However, in considering this alternative, staff did not alter the stroke length because, although older washing machines have higher agitation speeds, they also typically have lower stroke lengths (typically up to 90 degrees). In contrast, washing machines currently on the market, which have lower agitation speeds, also have larger stroke lengths (typically up to 220 degrees), thereby achieving the same wash results with lower agitation speeds.

To assess this lower agitation speed option, CPSC purchased a washing machine designed for testing laboratories that offers preprogrammed wash cycles or allows the user to program cycle parameters, subject to the machine's physical specification limits. All of the machine's programmable cycle parameters can meet the specifications in the Standard, except for the agitation speed. The maximum programmable agitation speed for the washing machine is 120 spm, lower than the 179 ± 2 spm required in the Standard. This option is referred to as "reduced agitation speed" in this notice because it has a reduced agitation speed, as compared to the Standard (although the agitation speed is higher than the second option, discussed below).

A second option staff considered to update the washing machine specifications was to follow the parameters in AATCC's Laboratory Procedure 1, *Home Laundering: Machine Washing* (LP1-2021), instead of the parameters in TM 124-2006. LP1-2021 is a voluntary standard that many testing laboratories already use for testing to other standards. A comment on the RFI recommended the use of this standard because it is similar to the current Standard; machines that meet it are readily available on the market; and the machines and standard are not expected to change significantly for some time.

LP1-2021 includes a lower agitation speed than the current Standard, but it also includes other differences in the washing and drying parameters. For this alternative, staff conducted comparison testing using washing machine parameters that conform to the provisions in:

- section 9.2 of LP1-2021, which includes a lower wash load size of 1.8 ± 0.1 kg (4.0 ± 0.2 pounds), compared to the current Standard;
- section 9.4 of LP1-2021, which requires the same detergent as the current Standard; and
- "(1) Normal" and "(IV) Hot" in Table 1, *Standard Washing Machine Parameters*, of LP1-2021, which specify the water level, agitation rate, stroke length, washing time, final spin speed and time, and wash temperature.

Staff used the drying parameters that conform to the provisions in:

- section 12.2(A) of LP1-2021, which are the same as those in the current Standard; and
- "(Aiii) Permanent Press" in Table VI, *Standard Tumble Dryer Parameters*, of LP1-2021, which specifies the maximum exhaust temperature and cool down time.

Based on these assessments, staff tested two potential laundering options as part of the comparison study. The first option was the reduced agitation speed for laundering (*i.e.*, the laundering specification in TM 124-2006, but with a reduced agitation speed) and the drying specifications in the Standard. The second was both the laundering and drying specifications stated above in LP1-2021. Note that when this notice references LP1-2021, it is referring only to the specific sections and tables stated above (*i.e.*, sections 9.2, 9.4, 12.2(A), Table 1 ((1) Normal and (IV) Hot), and Table VI ((Aiii) Permanent Press)), and not the entire LP1-2021 standard, which includes additional and alternative provisions. Table 3 provides a comparison of the washing and drying parameters in the current Standard, and the two alternatives staff assessed in comparison testing.

	Standard	Reduced	LP1-2021
		Agitation Speed	
Washing Machine Paramete	rs		
Agitation Speed, spm	179 ± 2	120 ± 2	86 ± 2
Water Level, L (gal)	$68 \pm 4 (18 \pm 1)$	$68 \pm 4 (18 \pm 1)$	$72 \pm 4 (19 \pm 1)$
Washing Time, min	12	12	16 ± 1
Spin Speed, rpm ²³	645 ± 15	645 ± 15	660 ± 15
Final Spin Time, min	6	6	5 ± 1
Wash Temperature, °C (°F)	$49 \pm 3 (120 \pm 5)$	$49 \pm 3 (120 \pm 5)$	$49 \pm 3 (120 \pm 5)$
Load size, kg (lbs)	≤ 3.63 (≤ 8)	\leq 3.63 (\leq 8)	$1.8 \pm 0.1 \ (4 \pm 0.2)$
AATCC 1993 Standard	66 ± 0.1	66 ± 0.1	66 ± 1
Reference Detergent, g (oz)	(2.3 ± 0.004)	(2.3 ± 0.004)	(2.3 ± 0.004)
Dryer Parameters			
Max. Dryer Exhaust	$66 \pm 5 (150 \pm 10)$	$66 \pm 5 (150 \pm 10)$	$68 \pm 6 \ (155 \pm 10)$
Temperature, °C (°F)			
Cool Down Time, min	10	10	≤10

 Table 3. Laundering procedure parameters.

b. Test Methods

To identify options that would yield flammability results comparable to the Standard, staff developed a comparison testing study that assessed the three alternative dry cleaning solvent options and the two alternative laundering options discussed above, in comparison to the dry cleaning and laundering provisions in the Standard.

Staff selected 11 fabrics for testing, including six plain surface textile fabrics and five raised surface textile fabrics. Staff included both plain and raised surface textile fabrics in the study because the Standard provides different criteria for classifying these fabric types. Staff chose samples that are representative of fabrics that typically require flammability testing²⁴ and yield both results that permit their use in clothing (Class 1 and 2) and do not (Class 3). Table 4 lists the fabrics used in the comparison study, as well as their characteristics.

Fabric	Description	Fabric Weight	Surface Type	Approximate
		(oz/yd^2)		Fabric Width (cm)
А	Silk, Chiffon, White	0.58	Plain	112
В	Silk, Habutae, White	1.06	Plain	114
С	Silk, Chiffon, Black	0.87	Plain	112
D	Rayon, Chiffon, white	2.0	Plain	137
Е	Cotton, Batiste	2.06	Plain	114
F	Cotton, Organdy	2.06	Plain	152
G	Cotton, Brushed, White	7.24	Raised	100
Н	Cotton Terry	9.02	Raised	152
Ι	Cotton, Chenille, White	10.0	Raised	142
J	Cotton, Chenille, Black	10.0	Raised	142
K	Rayon, Brushed, Black	3.08	Raised	152

Table 4. Fabrics used in comparison study.

Staff purchased at least 14 yards of each fabric, with widths between 40 and 60 inches, and they cut these into four 2-yard sections and one 6-yard section. One of the 2-yard sections of each fabric was tested in its original state, without refurbishing, in accordance with the Standard. To examine the dry cleaning options, each of the three 2-yard sections for each fabric was dry cleaned using one of the three dry cleaning procedures under consideration (*i.e.*, hydrocarbon, silicone, and butylal), and then laundered using the procedures required in the Standard. Staff used the laundering method in the Standard so that only one variable in the refurbishing process was changed (*i.e.*, dry cleaning), to allow clear comparisons of the effects of different dry cleaning methods on flammability test results.

To examine the laundering options, the 6-yard section of each fabric was dry cleaned in perchloroethylene, in accordance with the Standard, and then cut into three 2-yard sections, each of which underwent one of the three laundering procedures under consideration (*i.e.*, the Standard, reduced agitation speed, and LP1-2021). Staff used the dry cleaning method in the Standard so that only one variable in the refurbishing process was changed (*i.e.*, laundering), to allow clear comparisons of the effects of different laundering methods on flammability test results.

After these refurbishing procedures, staff cut each 2-yard section (including the 6 refurbished sections and 1 section in its original state) into thirty 2-by-6-inch specimens and performed flammability testing on those specimens, in accordance with the Standard. In total, this resulted in staff testing 2,310 specimens (11 fabrics \times 7 sections of each fabric \times 30 specimens of each sample).²⁵ Staff recorded the burn times and applicable burn codes for each specimen.

c. Results

Overall, the results of the comparison study indicate that all of the alternative dry cleaning specifications and laundering specifications yield flammability results comparable to

the Standard. Key results for the dry cleaning and laundering alternatives are provided in this section.

In understanding these results, it is important to note that, under the Standard, multiple specimens of a fabric must be tested, and burn codes and classifications are based on the results of these multiple specimens. The Standard specifies how to determine appropriate burn codes and classifications in light of these multiple specimens. Typically, fabric classification is determined by testing at least five specimens of a fabric. Thus, the results of a single specimen of fabric are not necessarily indicative of the final classification of the fabric. For example, if the results of a single specimen meet the criteria for Class 2 (*i.e.*, burn time of 4.0 to 7.0 seconds, with a burn code of SFBB), the final classification of the fabric may not be Class 2 because the final classification will depend on the results of the additional specimens of that fabric. Accordingly, the final classification of some fabrics discussed in this section cannot always be determined by the results presented here, but the range of possible classifications is determined. Particularly because the comparison testing assessed multiple specimens of the tabrics.

i. Dry Cleaning

The comparison study results for the three alternative dry cleaning specifications and the dry cleaning specifications in the Standard are presented below. Table 5 provides the aggregated results for all plain surface textile fabrics. Table 6 provides the results for the individual plain

surface textile fabrics and includes the number of samples tested that resulted in burn times,²⁶

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mean burn times, standard deviations, minimum burn times, and maximum burn times.

Table 5. Burn times for plain surface textile fabrics, aggregated, by dry cleaningprocedure.

Procedure	Number of	Mean Burn	Standard	Minimum	Maximum
	Samples with	Time	Deviation	Burn Time	Burn Time
	a Burn Time				
Standard	104	6.15 seconds	0.77	4.70 seconds	8.10 seconds
Hydrocarbon	94	6.05 seconds	0.88	4.90 seconds	9.40 seconds
Silicone	86	6.15 seconds	0.88	4.80 seconds	8.90 seconds
Butylal	115	6.09 seconds	0.77	4.80 seconds	7.90 seconds

Table 6. Burn times for plain surface textile fabrics (A through F), by dry cleaningprocedure.

Procedure	Number of	Mean Burn	Standard	Minimum	Maximum
	a Burn Time	Time	Deviation	Burn Time	Burn Time
Fabric A					
Standard	26	6.75 seconds	0.50	5.90 seconds	7.90 seconds
Hydrocarbon	16	6.83 seconds	0.37	6.20 seconds	7.60 seconds
Silicone	4	6.85 seconds	0.50	6.30 seconds	7.50 seconds
Butylal	27	6.31 seconds	0.30	5.70 seconds	6.80 seconds
Fabric B					
Standard	16	6.49 seconds	0.26	6.00 seconds	7.00 seconds
Hydrocarbon	9	6.53 seconds	0.35	6.10 seconds	7.00 seconds
Silicone	6	7.52 seconds	0.26	7.10 seconds	7.90 seconds
Butylal	7	7.29 seconds	0.43	6.70 seconds	7.90 seconds
Fabric C					
Standard	28	5.24 seconds	0.38	4.70 seconds	6.10 seconds
Hydrocarbon	29	5.28 seconds	0.32	4.90 seconds	6.60 seconds
Silicone	29	5.25 seconds	0.27	4.80 seconds	5.90 seconds
Butylal	3	5.38 seconds	0.34	4.90 seconds	6.60 seconds
Fabric D					
Standard	24	6.03 seconds	0.41	5.20 seconds	7.50 seconds
Hydrocarbon	27	5.62 seconds	0.28	4.90 seconds	6.20 seconds
Silicone	23	6.13 seconds	0.44	5.40 seconds	6.80 seconds
Butylal	27	5.54 seconds	0.40	4.80 seconds	6.20 seconds
Fabric E			-		
Standard	4	7.03 seconds	0.72	6.60 seconds	8.10 seconds
Hydrocarbon	4	7.58 seconds	1.22	6.80 seconds	9.40 seconds
Silicone	3	7.23 seconds	0.32	7.00 seconds	7.60 seconds
Butylal	6	6.98 seconds	0.29	6.70 seconds	7.50 seconds
Fabric F			-		
Standard	6	6.92 seconds	0.69	6.30 seconds	8.10 seconds
Hydrocarbon	9	7.23 seconds	0.66	6.40 seconds	8.10 seconds
Silicone	21	6.73 seconds	0.72	5.50 seconds	8.90 seconds
Butylal	18	6.99 seconds	0.40	6.40 seconds	7.90 seconds

²⁶ Although staff tested 30 specimens of each fabric/procedure combination, the number of samples with results in Tables 5 and 6 is not 30 because only samples with burn times, rather than DNI results, are provided in these tables. For DNI results, see Tab E of the briefing package supporting this NPR.

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As Table 5 shows, for plain surface textile fabrics, all three of the alternative dry cleaning options yielded very similar burn times to the Standard, including the mean, minimum, and maximum burn times. Table 6 shows the same is true for each plain surface textile fabric tested, with very similar mean, minimum, and maximum burn times for each alternative and the dry cleaning specification in the Standard.

For plain surface textile fabrics, burn time alone determines a fabric's classification, and a burn time of 3.5 seconds or more is Class 1, while a burn time of less than 3.5 seconds is Class 3. As Tables 5 and 6 show, for both the aggregated results and the individual fabric results, the Standard and all three alternative dry cleaning procedures yielded mean, minimum, and maximum burn times above the 3.5 second threshold and, therefore, yielded the same classification—Class 1—for all of the fabrics. Moreover, the mean, minimum, and maximum burn times were all sufficiently above the 3.5-second threshold that, even with some variability in burn times, the alternatives would not alter the classifications of these fabrics, when compared to the classifications under the Standard.²⁷ This demonstrates that, for plain surface textile fabrics, all three alternative dry cleaning procedures yield flammability results comparable to the Standard.

Table 7 provides the aggregated results for all raised surface textile fabrics, and Table 8 provides the results for the individual raised surface textile fabrics.

²⁷ Staff also considered the extent to which each of the three alternative dry cleaning options yielded DNI results versus burn times, as compared to the Standard. For plain surface textile fabrics, DNI results generally result in a fabric being Class 1. Because all of the plain surface textile fabrics in the comparison study of dry cleaning options yielded either DNI results or burn times of more than 3.5 seconds, they were all Class 1. Consequently, the results of DNI versus burn times for these fabrics are not presented here, since they do not alter the classifications. Moreover, it is expected that there will be variation in whether multiple specimens yield DNI or burn time results even when they are specimens of the same fabric that underwent the same refurbishing procedure. For details on these results, see Tab E of the briefing package supporting this NPR. THIS DOCUMENT HAS NOT BEEN

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Procedure	Number of Samples with a Burn Time	Mean Burn Time	Standard Deviation	Minimum Burn Time	Maximum Burn Time
Standard	150	11.87 seconds	7.45	2.30 seconds	27.30 seconds
Hydrocarbon	150	11.01 seconds	7.65	1.60 seconds	27.80 seconds
Silicone	150	10.57 seconds	7.08	1.90 seconds	32.70 seconds
Butylal	150	10.34 seconds	6.56	1.80 seconds	27.70 seconds

Table 7. Burn times for raised surface textile fabrics, aggregated, by dry cleaningprocedure.

Table 8.	Burn tim	es for raised	surface t	extile fabric	s (G throug	gh K), by d	Iry cleaning
			pro	ocedure.			

Procedure	Number of Samples with	Mean Burn Time	Standard Deviation	Minimum Burn Time	Maximum Burn Time
	a Burn Time				
Fabric G					
Standard	30	19.66 seconds	2.25	16.60 seconds	27.30 seconds
Hydrocarbon	30	16.77 seconds	2.55	11.10 seconds	25.10 seconds
Silicone	30	15.91 seconds	1.32	13.60 seconds	19.20 seconds
Butylal	30	13.72 seconds	1.59	8.20 seconds	15.80 seconds
Fabric H					
Standard	30	21.16 seconds	2.62	16.00 seconds	26.00 seconds
Hydrocarbon	30	22.25 seconds	3.10	13.30 seconds	27.80 seconds
Silicone	30	20.60 seconds	5.00	13.90 seconds	32.70 seconds
Butylal	30	20.76 seconds	2.83	15.00 seconds	27.70 seconds
Fabric I					
Standard	30	7.18 seconds	1.45	5.00 seconds	12.70 seconds
Hydrocarbon	30	5.91 seconds	1.45	4.00 seconds	8.80 seconds
Silicone	30	6.00 seconds	1.13	4.30 seconds	10.10 seconds
Butylal	30	6.53 seconds	1.21	4.80 seconds	9.00 seconds
Fabric J					
Standard	30	2.84 seconds	0.28	2.30 seconds	3.40 seconds
Hydrocarbon	30	2.23 seconds	1.60	1.60 seconds	3.20 seconds
Silicone	30	2.60 seconds	1.90	1.90 seconds	4.20 seconds
Butylal	30	2.48 seconds	1.80	1.80 seconds	3.30 seconds
Fabric K					
Standard	30	8.51 seconds	0.77	7.10 seconds	10.50 seconds
Hydrocarbon	30	7.88 seconds	0.88	6.60 seconds	10.50 seconds
Silicone	30	7.74 seconds	0.69	6.50 seconds	9.40 seconds
Butylal	30	8.18 seconds	0.88	6.00 seconds	10.40 seconds

As Table 7 shows, for raised surface textile fabrics, all three of the alternative dry cleaning options yielded burn times very similar to the Standard, including the mean, minimum, and maximum burn times. Table 8 shows the same is true for each raised surface textile fabric tested, with similar mean, minimum, and maximum burn times for each alternative and the dry cleaning specification in the Standard. Tables 7 and 8 also illustrate the wide variability in burn times for raised surface textile fabrics, even when testing the same fabric with the same dry cleaning THIS DOCUMENT HAS NOT BEEN CLEARED FOR PUBLIC RELEASE UNDER CPSA 6(b)(1). REVIEWED OR ACCEPTED BY THE COMMISSION.

procedure. This variation is expected, particularly for raised surface textile fabrics, both within results for a single fabric and across different fabric types.

For raised surface textile fabrics, classifications are generally based on both burn time and burn behavior, as indicated by burn codes.²⁸ However, one classification for raised surface textile fabrics is based solely on burn time—specifically, a raised surface textile fabric is Class 1 if it has an average burn time greater than 7.0 seconds, regardless of burn behavior. For raised surface textile fabrics with an average burn time of 7.0 seconds or less, classifications depend on both burn behavior and burn time. If a fabric has an average burn time of 7.0 seconds or less and does not have a burn code of SFBB, then it is Class 1. If it has an average burn time of 4.0 to 7.0 seconds, and multiple specimens of the fabric have a burn code of SFBB, then it is Class 2. If it has an average burn time of less than 4.0 seconds, and multiple specimens have a burn code of SFBB, then it is Class 3. As discussed in the proposed revisions to burn codes, above, only a burn code of SFBB—not SFBB poi or SFBB poi*—determines the classification of the fabric.

As the results in Table 7 show, using the mean burn times, all of the alternative dry cleaning procedures yielded the same Class 1 results as the Standard. These mean results were also sufficiently above the 7.0-second threshold that, even with some variability in burn times, the alternatives would not alter the classifications when compared to the classifications under the Standard. The wide range of minimum and maximum burn times in Table 7 is the result of variations in different raised surface textile fabrics. The results of individual fabrics are discussed below.

The results for Fabric G, in Table 8, show that the mean, minimum, and maximum burn times for this fabric were all above the 7.0-second threshold and, therefore, Class 1, using any of the three alternatives or the Standard. Even with some variability in burn times, the burn times

were sufficiently above the 7.0-second threshold that this would not alter the classifications. In addition, staff found that all of the specimens tested under the three alternatives and the Standard yielded burn codes of SFBB poi. The same is true of the burn time and burn code results for Fabric H, in Table 8. This demonstrates that the classifications for Fabrics G and H would be the same under any of the three alternative dry cleaning procedures as they are under the Standard, making them all comparable alternatives.

The results for Fabric I illustrate that the mean and range of burn times for the three alternative dry cleaning procedures are similar to that of the Standard, but that all four methods have some variability clustered close to the burn time thresholds for different classifications. This makes burn codes relevant for purposes of determining classifications. Staff found that all 30 specimens of Fabric I tested using the Standard, silicone, and butylal had burn codes of SFBB poi, and that hydrocarbon yielded burn codes of SFBB (8 specimens), SFBB poi (17 specimens), and SFBB poi* (5 specimens). As such, Fabric I was Class 1 under the Standard, silicone, and butylal, but 8 of the specimens could potentially yield Class 2 or 3 results under the hydrocarbon option, depending on the burn time and the results of additional specimens. Although the hydrocarbon alternative could potentially result in different classifications than the Standard, these divergent results were limited to a small proportion of the hydrocarbon results, and most hydrocarbon results aligned with the classifications under the Standard.

The results for Fabric J also illustrate that the mean and range of burn times for the three alternative dry cleaning procedures are similar to that of the Standard. However, because the mean, minimum, and maximum are all well below the 7.0-second threshold for which classification can be determined solely by burn times, burn codes are relevant for determining the classifications of these specimens.

Staff found that, under the dry cleaning procedure in the Standard, 27 of the specimens of Fabric J had a burn code of SFBB poi (making them Class 1) and 3 had a burn code of SFBB
(potentially making them Class 2 or 3, depending on burn time and results of other specimens). The hydrocarbon alternative yielded 22 specimens with a burn code of SFBB poi (making them Class 1) and 8 with burn code of SFBB (potentially making them Class 2 or 3, depending on burn time and results of other specimens). In total, 11 specimens tested under the hydrocarbon alternative yielded different burn codes than the Standard and 19 specimens yielded the same burn codes under both methods. The silicone alternative yielded 24 specimens with a burn code of SFBB poi and 1 with a burn code of SFBB poi* (making them Class 1), along with 5 with burn code of SFBB (potentially making them Class 2 or 3, depending on burn time and results of other specimens). In total, 9 specimens tested under the silicone alternative yielded different burn codes than the Standard and 21 specimens yielded the same burn codes under both methods. The butylal alternative yielded 16 specimens with a burn code of SFBB poi (making them Class 1), and 14 with a burn code of SFBB (potentially making them Class 2 or 3, depending on burn time and results of other specimens). In total, 17 specimens tested under butylal alternative yielded different burn codes than the Standard and 13 specimens yielded the same burn codes under both methods.

This indicates that, for Fabric J, all three alternative dry cleaning options could result in different classifications than the Standard. However, it also indicates that, overall, a small proportion of the classifications under hydrocarbon and silicone have the potential to yield different classifications than the Standard, and most hydrocarbon and silicone results aligned with the classifications in the Standard. In addition, the number of hydrocarbon and silicone results that diverged from the Standard were similar, whereas divergent classifications were far more common for butylal.

The results for Fabric K illustrate that the mean and range of burn times for the three alternative dry cleaning procedures are similar to that of the Standard, but that all four methods have some variability clustered close to the burn time thresholds for different classifications.

Staff found that all 30 specimens of Fabric K tested using the Standard, hydrocarbon, silicone, and butylal had burn codes of SFBB poi, making them all Class 1 under every option. This demonstrates that the classifications for Fabric K would be the same under any of the three alternative dry cleaning procedures as they are under the Standard, making them all comparable alternatives.

ii. Laundering

The comparison study results for the two alternative laundering specifications and the laundering specifications in the Standard are presented below. Table 9 provides the aggregated results for all plain surface textile fabrics. Table 10 provides the results for the individual plain surface textile fabrics and includes the number of samples tested that resulted in burn times,²⁹ mean burn times, standard deviations, minimum burn times, and maximum burn times.

Table 9. Burn times for plain surface textile fabrics, aggregated, by laundering procedure.								
Procedure	Number of	Mean Burn	Standard	Minimum	Maximum			
	Samples	Time	Deviation	Burn Time	Burn Time			
	with a							
	Burn Time							
Standard	104	6.15 seconds	0.77	4.70 seconds	8.10 seconds			
Reduced	126	6.25 seconds	0.71	4.80 seconds	8.20 seconds			
Agitation Speed								
LP1-2021	86	6.12 seconds	0.92	4.60 seconds	9.50 seconds			

Table 10. Burn times for plain surface textile fabrics (A through F), by laundering
procedure

Procedure	Number of Samples with a Burn Time	Mean Burn Time	Standard Deviation	Minimum Burn Time	Maximum Burn Time
Fabric A					
Standard	26	6.75 seconds	0.50	5.90 seconds	7.90 seconds
Reduced Agitation	24	6.79 seconds	0.27	6.20 seconds	7.30 seconds
Speed					
LP1-2021 18		7.12 seconds	0.27	6.80 seconds	7.70 seconds
Fabric B					
Standard	16	6.49 seconds	0.26	6.00 seconds	7.00 seconds
Reduced Agitation	28	6.43 seconds	0.32	5.60 seconds	7.10 seconds
Speed					
LP1-2021	22	6.38 seconds	0.32	5.80 seconds	7.10 seconds

²⁹ Although staff tested 30 specimens of each fabric/procedure combination, the number of samples with results in Table 10 is not 30 because only samples with burn times, rather than DNI results, are provided in the table. For DNI results, see Tab E of the briefing package supporting this NPR.

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Fabric C					
Standard	28	5.24 seconds	0.38	4.70 seconds	6.10 seconds
Reduced Agitation	30	5.30 seconds	0.34	4.80 seconds	6.20 seconds
Speed					
LP1-2021	29	5.12 seconds	0.35	4.60 seconds	6.00 seconds
Fabric D					
Standard	24	6.03 seconds	0.41	5.20 seconds	7.50 seconds
Reduced Agitation	26	6.16 seconds	0.41	5.60 seconds	7.10 seconds
Speed					
LP1-2021	12	5.98 seconds	0.36	5.60 seconds	7.10 seconds
Fabric E					
Standard	4	7.03 seconds	0.72	6.60 seconds	8.10 seconds
Reduced Agitation	6	7.53 seconds	0.42	7.20 seconds	8.20 seconds
Speed					
LP1-2021	4	7.75 seconds	1.20	6.80 seconds	9.50 seconds
Fabric F					
Standard	6	6.92 seconds	0.69	6.30 seconds	8.10 seconds
Reduced Agitation	12	6.94 seconds	0.52	6.20 seconds	7.90 seconds
Speed					
LP1-2021	1	6.60 seconds	Not	6.60 seconds	6.60 seconds
			applicable		

As Table 9 shows, for plain surface textile fabrics, both of the alternative laundering options yielded very similar burn times to the Standard, including the mean, minimum, and maximum burn times. Table 10 shows the same is true for each plain surface textile fabric tested, with very similar mean, minimum, and maximum burn times for each alternative and the laundering specification in the Standard. As Tables 9 and 10 show, for both the aggregated results and the individual fabric results, the Standard and both alternative laundering procedures yielded mean, minimum, and maximum burn times above the 3.5-second threshold for plain surface textile fabrics and, therefore, yielded the same classification—Class 1—for all of the fabrics. Moreover, the mean, minimum, and maximum burn times were all sufficiently above the 3.5-second threshold that, even with some variability in burn times, the alternatives would not alter the classifications of these fabrics, when compared to the classifications under the Standard.³⁰ This demonstrates that, for plain surface textile fabrics, both alternative laundering procedures procedures are comparable to the Standard.

³⁰ Like the dry cleaning results, staff also considered the extent to which both of the alternative laundering options yielded DNI results versus burn times, as compared to the Standard. Again, because all of the plain surface textile

Table 11 provides the aggregated results for all raised surface textile fabrics, and Table

12 provides the results for the individual raised surface textile fabrics.

 Table 11. Burn times for raised surface textile fabrics, aggregated, by laundering procedure.

Procedure	Number of Samples with a Burn Time	Mean Burn Time	Standard Deviation	Minimum Burn Time	Maximum Burn Time
Standard	150	11.87 seconds	7.45	2.30 seconds	27.30 seconds
Reduced	150	10.86 seconds	6.55	2.20 seconds	24.90 seconds
Agitation Speed					
LP1-2021	150	10.76 seconds	6.72	2.00 seconds	31.50 seconds

Table 12. Burn times for raised surface textile fabrics (G through K), by launderingprocedure.

Procedure Number of		Mean Burn	Standard	Minimum	Maximum
	Samples	Time	Deviation	Burn Time	Burn Time
	with a Burn				
	Time				
Fabric G	1			1	
Standard	30	19.66 seconds	2.25	16.60 seconds	27.30 seconds
Reduced	30	17.93 seconds	2.30	10.10 seconds	22.50 seconds
Agitation Speed					
LP1-2021	30	16.80 seconds	2.13	13.80 seconds	22.90 seconds
Fabric H	-	-	_		
Standard	30	21.16 seconds	2.62	16.00 seconds	26.00 seconds
Reduced	30	18.54 seconds	2.90	10.90 seconds	24.90 seconds
Agitation Speed					
LP1-2021	30	19.55 seconds	3.82	11.40 seconds	31.50 seconds
Fabric I					
Standard	30	7.18 seconds	1.45	5.0 seconds	12.70 seconds
Reduced	30	6.38 seconds	1.00	4.80 seconds	8.70 seconds
Agitation Speed					
LP1-2021	30	6.31 seconds	1.03	4.30 seconds	9.10 seconds
Fabric J	-		_		
Standard	30	2.84 seconds	0.28	2.30 seconds	3.40 seconds
Reduced	30	2.89 seconds	0.34	2.20 seconds	3.50 seconds
Agitation Speed					
LP1-2021	30	2.74 seconds	0.37	2.00 seconds	3.80 seconds
Fabric K					
Standard	30	8.51 seconds	0.77	7.10 seconds	10.50 seconds
Reduced	30	8.58 seconds	0.81	7.40 seconds	11.20 seconds
Agitation Speed					
LP1-2021	30	8.38 seconds	1.10	7.20 seconds	12.90 seconds

fabrics in the comparison study of laundering options yielded either DNI results or burn times of more than 3.5 seconds, they were all Class 1. Consequently, the results of DNI versus burn times for these fabrics are not presented here, since they do not alter the classifications. Moreover, it is expected that there will be variation in whether multiple specimens yield DNI or burn time results even when they are specimens of the same fabric that underwent the same refurbishing procedure. For details on these results, see Tab E of the briefing package supporting this NPR. THIS DOCUMENT HAS NOT BEEN CLEARED FOR PUBLIC RELEASE UNDER CPSA 6(b)(1). REVIEWED OR ACCEPTED BY THE COMMISSION.

As Table 11 shows, for raised surface textile fabrics, the alternative laundering options yielded very similar burn times to the Standard, including the mean, minimum, and maximum burn times. Table 12 shows that, for each raised surface textile fabric tested, there were also similar mean, minimum, and maximum burn times for each alternative and the laundering specification in the Standard. Tables 11 and 12 also illustrate the wide variability in burn times for raised surface textile fabrics, even when testing the same fabric with the same laundering procedure. As explained above, this variation is expected, particularly for raised surface textile fabrics, both within results for a single fabric and across different fabric types.

As the results in Table 11 show, both of the alternative laundering procedures yielded the same Class 1 results as the Standard since they all had mean burn times above 7.0 seconds. These mean results were also sufficiently above the 7.0 second threshold that, even with some variability in burn times, the alternatives would not alter the classifications when compared to the classifications under the Standard. The wide range of minimum and maximum burn times in Table 11 is the result of variations in different raised surface textile fabrics, which behaved similarly for the laundering alternatives and the dry cleaning alternatives. The results of individual fabrics are discussed below.

The results for Fabric G, in Table 12, show that the mean, minimum, and maximum burn times for this fabric were all well above the 7.0-second threshold and, therefore, Class 1 using either of the alternatives or the Standard. Even with some variability in burn times, the burn times were sufficiently above the 7.0-second threshold that this would not alter the classifications. In addition, all of the specimens tested under both alternatives and the Standard yielded burn codes of SFBB poi. The same is true of the burn time and burn code results for Fabric H, in Table 12. This demonstrates that the classifications for Fabrics G and H would be the same under either of the alternative laundering procedures as they are under the Standard, making them both comparable alternatives.

The results for Fabric I illustrate that the mean and range of burn times for the two alternative laundering procedures are similar to that of the Standard, but that all three methods have some variability clustered close to the burn time thresholds for different classifications. This makes burn codes relevant for purposes of determining classifications. Staff found that all 30 specimens of Fabric I tested using the Standard and both laundering alternatives had burn codes of SFBB poi, making all of them Class 1, regardless of burn time. This demonstrates that the classification for Fabric I would be the same under either of the alternative laundering procedures as they are under the Standard, making them both comparable alternatives.

The results for Fabric J also illustrate that the mean and range of burn times for the two alternative laundering procedures are very similar to that of the Standard. Because the mean, minimum, and maximum are all well below the 7.0-second threshold for which classification can be determined solely by burn times, burn codes are relevant for determining the classifications of these specimens. Staff found that, under the laundering procedure in the Standard, 27 specimens of Fabric J had a burn code of SFBB poi (making them Class 1) and 3 had a burn code of SFBB (potentially making them Class 3 depending on the results of other specimens because all burn times were less than 4.0 seconds). The reduced agitation speed alternative yielded 24 specimens with a burn code of SFBB poi (making them Class 1) and 6 with a burn code of SFBB (potentially making them Class 3 depending on the results of other specimens because all burn times were less than 4.0 seconds). In total, 5 specimens tested under the reduced agitation speed alternative yielded different burn codes than the Standard. The LP1-2021 alternative yielded 27 specimens with a burn code of SFBB poi (making them Class 1) and 3 with a burn code of SFBB (potentially making them Class 3 depending on the results of other specimens because all burn times were less than 4.0 seconds). In total, 6 specimens tested under LP1-2021 yielded different burn codes than the Standard.

This indicates that although both alternative laundering options could result in different classifications than the Standard, only a very small proportion of the results indicate this, and most results align with the classifications in the Standard. In addition, the number of reduced agitation speed and LP1-2021 burn code results that diverged from the Standard were nearly identical, indicating they provide similar equivalency to the Standard. Also, there were fewer classifications that differed when comparing LP1-2021 results and those under the Standard than when comparing the reduced agitation speed option to the Standard.

The results for Fabric K show that the mean, minimum, and maximum burn times for this fabric were all above the 7.0-second threshold and, therefore, Class 1 using either of the laundering alternatives or the Standard. However, because some of the burn times were close to this threshold, staff also considered their burn behavior. Staff found that all 30 specimens of Fabric K tested using the Standard, the reduced agitation speed alternative, and the LP1-2021 alternative had burn codes of SFBB poi. As such, even if burn times had been below the 7.0-second threshold, they would all still be Class 1 under every option. This demonstrates that the classifications for Fabric K would be the same under either of the alternative laundering procedures as they are under the Standard, making them all comparable alternatives.

3. Proposed Amendments and Rationale

a. Dry Cleaning

Based on staff's assessment and testing, the Commission proposes to amend the dry cleaning solvent requirements in the Standard to include, as an alternative to commercial grade perchloroethylene, commercial grade hydrocarbon solvent. Specifically, the Commission proposes to specify that the following conditions are permissible:

- hydrocarbon solvent,
- cationic detergent class,
- 20-25 minutes cleaning time,

- 4 minutes extraction time,
- 60-66°C (140-150°F) drying temperature,
- 20-25 minutes drying time, and
- 5 minutes cool down/deodorization time.

The Commission is not proposing to remove the perchloroethylene option from the Standard because this procedure is still available and widely used. However, because of the increasing restrictions on the use of perchloroethylene, the Commission proposes to also allow hydrocarbon as an alternative dry cleaning method. This would allow testing laboratories to continue to use perchloroethylene where it is available and permissible but accommodate testing laboratories that can no longer access or use this method.

As the comparison testing indicates, all three alternative dry cleaning procedures that staff tested would provide comparable and acceptable alternatives to the dry cleaning procedures in the Standard. Overall, fabrics yielded the same classifications under the hydrocarbon alternative as they did under the Standard. Although a small portion of the raised surface textile fabrics showed the potential to result in different classifications using hydrocarbon solvent, compared to the Standard, this was true for all three alternatives considered, and less so for hydrocarbon and silicone than for butylal; this only applied to a small portion of the fabrics and hydrocarbon results; variability in results was evident even in the results under the current Standard; and variability in flammability results is expected across specimens of the same fabric using the same procedure, particularly for raised surface fabrics. As such, in general, hydrocarbon solvent yields comparable flammability results to the Standard and is among the best options available to provide the needed alternative to perchloroethylene for testing laboratories that can no longer use that solvent. In addition, the Commission proposes to allow the use of hydrocarbon solvent, rather than silicone or butylal, because it is the most commonly used alternative to perchloroethylene, has a long history of use, and is less expensive than other

alternatives. Also, several companies manufacture hydrocarbon solvents for dry cleaning, whereas silicone and butylal are newer technologies and patented, making their availability more limited.

However, CPSC also considered several variations on this proposal, including whether perchloroethylene should remain an option, and whether some other alternative or combination of alternatives including hydrocarbon, silicone, and butylal, should be permissible. The Commission requests comments on the proposed revision, including the solvent and associated parameters, the comparison testing, and the justifications for the proposed requirement. The Commission also requests comments on the alternatives considered and the justifications for them.

b. Laundering

Proposed amendments. Based on staff's assessment and testing, the Commission proposes to amend the laundering specifications in the Standard to remove the incorporation by reference of TM 124-2006 and, instead, incorporate by reference LP1-2021. Specifically, the Commission proposes to require that:

- washing conform to the provisions in section 9.2 and 9.4, and the provisions for "(1) Normal" and "(IV) Hot" in Table 1, *Standard Washing Machine Parameters*, of LP1-2021; and
- drying conform to the provisions in section 12.2(A), and the provisions for "(Aiii) Permanent Press" in Table VI, *Standard Tumble Dryer Parameters*, of LP1-2021.

These specifications are those staff used during comparison testing and are shown in Table 3, above.

In addition, for purposes of 16 CFR 1610.40, the Commission preliminarily concludes that the testing CPSC staff conducted that is provided in this notice and in full detail in Tabs D

and E of the briefing package supporting this proposed rule³¹ constitutes information demonstrating that the washing procedure specified in the current Standard—that is:

- in compliance with sections 8.2.2, 8.2.3 and 8.3.1(A) of TM 124-2006,
- using AATCC 1993 Standard Reference Detergent, powder,
- with wash water temperature (IV) (120° ± 5°F; 49° ± 3°C) specified in Table II of TM 124-2006,
- using water level, agitation speed, washing time, spin speed and final spin cycle for "Normal/Cotton Sturdy" in Table III of TM 124-2006, and
- with a maximum wash load of 8 pounds (3.63 kg) and consisting of any combination of test samples and dummy pieces—

is as stringent as the washing procedure in LP1-2021 that is proposed to be required in this NPR. If firms rely on this information and conform to the other requirements in section 1610.40, this will provide an option for them to continue to use washing machines that comply with the provisions in TM 124-2006 in the current Standard.

Likewise, for purposes of 16 CFR 1610.40, the Commission preliminarily concludes that the testing CPSC staff conducted that is provided in this notice and in full detail in Tabs D and E of the briefing package supporting this proposed rule³² constitutes information demonstrating that the drying procedure specified in the current Standard—that is:

- in compliance with section 8.3.1(A), Tumble Dry, of TM 124-2006,
- using the exhaust temperature (150° ± 10°F; 66° ± 5°C) specified in Table IV, "Durable Press," of TM 124-2006, and
- with a cool down time of 10 minutes specified Table IV, "Durable Press," of TM 124-2006—

is as stringent as the drying procedure in LP1-2021 that is proposed to be required in this NPR. If firms rely on this information and conform to the other requirements in section 1610.40, this will provide an option for them to continue to use dryers that comply with the provisions in TM 124-2006 in the current Standard.

Allowance in 16 CFR 1610.40. Although the Commission is proposing to require the use of laundering machines that comply with specified provisions in LP1-2021, testing laboratories could continue to use machines that comply with the provisions of TM 124-2006 referenced in the current Standard, in accordance with 16 CFR 1610.40.

As discussed above, section 1610.40 allows the use of alternative apparatus, procedures, or criteria for tests for guaranty purposes when reasonable and representative tests that use apparatus or procedures other than those in the Standard confirm compliance with the Standard, under specified conditions. This allowance specifies that an alternative must be as stringent as, or more stringent than the Standard, and that the Commission considers an alternative to meet this requirement "if, when testing identical specimens, the alternative test yields failing results as often as, or more often than, the test" in the Standard. Anyone using an alternative under this allowance must have data or information demonstrating this required stringency and retain it while the alternative is used to support a guaranty and for one year after. See 16 CFR part 1610 for full details regarding this allowance.

If the Commission finalizes this proposed rule and requires the use of laundering specifications in LP1-2021, then testing laboratories that want to continue to use laundering specifications that meet the specifications of TM 124-2006 that are referenced in the current Standard could use the results of staff's comparison testing to demonstrate that the laundering specification in TM 124-2006 that is referenced in the current Standard is as stringent as or more stringent than the specifications in LP1-2021 referenced in the proposed amendment. The following summarizes how staff's comparison testing demonstrates that the laundering

specification in TM 124-2006 yields failing results as often as, or more often than the laundering specification in LP 1-2021, when testing identical specimens.

As discussed above, the aggregated results for both plain and raised surface textile fabrics (Tables 9 and 11) show that the mean burn times and classifications are comparable when specimens are laundered in accordance with the relevant specifications in TM 124-2006 or LP1-2021. More specifically, all of the individual plain surface textile fabrics yielded the same classifications—Class 1—whether tested in accordance with the relevant laundering procedures in TM 124-2006 or LP1-2021 and had sufficiently high burn times to consistently yield the same classifications, even if there was slight variability in burn times (Table 10). This demonstrates that, for plain surface textile fabrics, the relevant specifications in TM 124-2006 are as stringent as LP1-2021 since they yield failing results as often as LP1-2021.

Similarly, of the raised surface textile fabrics, Fabrics G, H, I, and K yielded the same classifications—Class 1—whether tested in accordance with the relevant laundering specifications in TM 124-2006 or LP1-2021 and had sufficiently high burn times and identical burn codes to consistently yield the same classifications, even if there was slight variability in burn times (Table 12). Only Fabric J had some deviations in burn codes, but even with these deviations, the classifications were the same. Specifically, although 6 of the 30 specimens of Fabric J tested under the laundering specification in LP1-2021 yielded different burn codes than those specimens tested under TM 124-2006, both laundering procedures still resulted in 27 of the 30 specimens with burn codes and burn times that would yield Class 1 results and three specimens with burn codes and burn times that could yield Class 3 results depending on the results of other specimens. Because flammability results are based on the final classification, and not just burn codes, this demonstrates that, for raised surface textile fabrics, the relevant laundering specifications in TM 124-2006 are as stringent as those in LP1-2021 since they yield failing results as often as LP1-2021.

Based on this information, the Commission preliminarily concludes that this NPR and the information provided in Tabs D and E of the briefing package supporting this proposed rule³³ satisfy the documentation requirements in section 1610.40 by demonstrating the necessary equivalency of the laundering specifications in TM 124-2006 that are referenced in the current Standard and those in LP1-2021 that the Commission proposes to adopt. If firms rely on this information and conform to the other requirements in section 1610.40, this will provide an option for them to continue to use laundering machines that comply with TM 124-2006 after the effective date of a final rule amending these provisions. This would minimize the impact of the proposed amendments on testing laboratories.

Comparison. As explained above, the laundering parameters in LP1-2021 differ somewhat from those in the Standard. Table 13 shows a comparison of the parameters. Although agitation speed is the only parameter of the Standard that machines can no longer meet, the Commission is proposing to require additional parameters from LP1-2021 as well, all of which were used during comparison testing. As explained above, certain parameters must be adjusted to accommodate other parameter changes, as certain parameters work in concert (*e.g.*, agitation speed and stroke length). In addition, certain parameters must be adjusted to reflect parameters for which LP1-2021 washing machines are designed (*e.g.*, load size). Finally, using all relevant parameters from a single standard provides for better clarity and ease of use.

	Standard	LP1-2021						
Washing Machine Parameters								
AATCC 1993 Standard	$66 \pm 0.1 \text{ g}$	$66 \pm 1 \text{ g}$						
Reference Detergent	$(2.3 \pm 0.004 \text{ oz})$	$(2.3 \pm 0.004 \text{ oz})$						
Water Level	$68 \pm 4 \text{ L} (18 \pm 1 \text{ gal})$	$72 \pm 4 L (19 \pm 1 gal)$						
Agitation Speed	179 ± 2 spm	86 ± 2 spm						
Stroke Length	Not specified	Up to 220°						
Washing Time	12 min	$16 \pm 1 \min$						
Spin Speed	645 ± 15 rpm	660 ± 15 rpm						
Final Spin Time	6 min	$5 \pm 1 \min$						
Wash Temperature	$49 \pm 3^{\circ} C (120 \pm 5^{\circ} F)$	$49 \pm 3^{\circ} C (120 \pm 5^{\circ} F)$						
Load size	Maximum 8 lbs (3.63 kg)	4 ± 0.2 lbs $(1.8 \pm 0.1$ kg)						

	Ta	able	e 13.	Con	nparison	of	laund	lering	procedure	parameters.
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		Note that the proposed rule sets this as a maximum.
Dryer Parameters		
Maximum Dryer Exhaust	$66 \pm 5^{\circ}C (150 \pm 10^{\circ}F)$	$68 \pm 6 \ ^{\circ}\text{C} \ (155 \pm 10^{\circ}\text{F})$
Temperature		
Cool Down Time	10 min	≤10 min

Rationale. The Commission proposes to incorporate by reference the laundering specifications in LP1-2021, instead of requiring the reduced agitation speed alternative (*i.e.*, maintaining the requirement to meet specifications in TM 124-2006, but with a reduced agitation speed), for several reasons. For one, LP1-2021 is a standard that is commonly used by testing laboratories to launder samples for other tests. As such, testing laboratories are likely to already have this standard, be familiar with it, and have machines that comply with it. Also, there are more washing machines on the market that meet the specifications in LP1-2021 than the reduced agitation speed parameters staff examined. It is likely that only programmable washing machines where the agitation speed can be set by the user would be able to meet the reduced agitation speed parameters, whereas, both programmable machines and those with set parameters built to meet LP1-2021 specifications would be able to meet the proposed requirement.

Finally, as the comparison study results show, both the reduced agitation speed and LP1-2021 alternatives yield nearly identical classifications as the Standard, with only one raised surface textile fabric—Fabric J—having slightly different results when comparing the Standard and the alternatives. However, even for that fabric, the Standard and LP1-2021 yielded the same number of Class 1 results (27 specimens), while the reduced agitation speed alternative yielded 26 Class 1 results. As such, overall, fabrics yielded the same classifications under the LP1-2021 alternative as they did under the Standard and LP1-2021 is among the best options available to provide the needed alternative to TM 124-2006 since testing laboratories can no longer obtain washing machines that comply with that standard.

In addition to updating the washing machine specifications stated in section 1610.6(b)(1)(ii), the Commission proposes to update the drying specifications in that section to THIS DOCUMENT HAS NOT BEEN REVIEWED OR ACCEPTED BY THE COMMISSION. CLEARED FOR PUBLIC RELEASE UNDER CPSA 6(b)(1).

also incorporate by reference LP1-2021, for consistency and simplicity. Although clothes dryers have not changed significantly in recent years and machines that comply with TM 124-2006 are still available on the market, the Commission proposes to update this requirement for several reasons. For one, it is preferable for testing to follow the procedures and specifications in one standard for the entire laundering process, rather than using components of different standards for washing and drying, to ensure consistent and compatible testing. In addition, using two separate standards for washing and drying could lead to confusion or errors in testing, which could affect flammability results. Also, obtaining and maintaining two separate standards potentially would be cumbersome and slightly more costly for testing laboratories. Because many testing laboratories likely already have and are familiar with LP1-2021 to test for compliance with other standards, requiring the use of only this standard would be simpler, clearer, and less costly.

Finally, the dryer specifications in TM 124-2006 and LP1-2021 are nearly identical, which means the proposed update is unlikely to require testing laboratories to replace dryers that comply with the current Standard. As explained above, the Standard currently requires that drying be performed in accordance with section 8.3.1(A) of TM 124-2006 using the exhaust temperature and cool down time specified in "Durable Press" of Table IV of that standard. The Commission proposes to require that drying be performed in accordance with section 12.2(A) of LP1-2021 using the exhaust temperature and cool down time specified in "(Aiii) Permanent Press" of Table VI of that standard. These requirements are nearly identical—the comparison is discussed below.

Section 8.3.1(A) of TM 124-2006 and section 12.2(A) of LP1-2021 include essentially identical requirements that simply require tumble drying and immediate removal of samples. Similarly, reference to "Permanent Press" instead of "Durable Press" does not alter any

requirements because the two terms have the same meaning—permanent press is simply the term more commonly used by industry currently.

As for exhaust temperature, in TM 124-2006, "Durable Press" of Table IV specifies that the dryer exhaust temperature is $66 \pm 5^{\circ}$ C, whereas, in LP1-2021, (Aiii) "Permanent Press" of Table VI specifies that the maximum dryer exhaust temperature is $68 \pm 6^{\circ}$ C. As such, the range of exhaust temperatures is nearly identical in both standards, with TM 124-2006 allowing a range of 61-71°C and LP1-2021 allowing a range of 62-74°C. Thus, by updating the Standard to require the use of LP1-2021, only dryers with an exhaust temperature of precisely 61°C would no longer be permissible, and dryers with exhaust temperatures of 72-74°C would become permissible. Because most dryers are designed to target the mid-range of permissible temperatures, staff does not expect many dryers to fall outside the range that is permissible under both standards. To the extent that a dryer complies with the current Standard, but not the exhaust temperature range in LP1-2021, Table VI, (Aiii) Permanent Press, testing laboratories would have section 1610.40 as an option to continue using their existing dryers.

Similarly, with respect to cool down time, TM 124-2006, "Durable Press" of Table IV specifies that the cool down time is 10 minutes, whereas in LP1-2021, (Aiii) "Permanent Press" of Table VI specifies that the cool down time is 10 minutes or less. As such, by updating the Standard to require the use of LP1-2021, there is a wider allowance for cool down time, including that specified in TM 124-2006.

Based on the very minor differences between the dryer specifications in TM 124-2006 and LP1-2021, staff expects that this proposed update would not require testing laboratories to replace any dryers because all machines that comply with TM 124-2006 are likely to also comply with LP1-2021, and the allowance in 16 CFR 1610.40 is available for the small number of machines that may become non-compliant.

Alternatives. The Commission considered several variations on this proposal. One alternative the Commission considered is to update the incorporation by reference in the Standard from TM 124-2006 to the most recent version of that standard, TM 124-2018. AATCC has updated TM 124 several times since 2006 (in 2009, 2010, 2011, 2014, and 2018) to reflect the evolving specifications of machines available on the market. In the 2010 and 2011 versions of the standard, AATCC removed the table specifying the washing machine parameters that is referenced in the Commission's regulations, instead referencing AATCC Monograph 6 "Standardization of Home Laundry Test Conditions." AATCC later replaced the reference to Monograph 6 with reference to LP1, and then later revised TM 124 again to include a table specifying washing machine parameters.

The washing and drying specifications in TM 124-2018 are the same as those the Commission proposes to incorporate by reference from LP1-2021, but the Commission is not proposing to incorporate by reference TM 124-2018 for several reasons. For one, unlike LP1-2021 and the relevant provisions in the Standard, TM 124 is not just a laundering procedure—it is primarily intended to evaluate the smoothness appearance of fabrics after laundering and, accordingly, has procedures addressing that purpose. In contrast, the Standard is intended only for flammability assessments, and LP1-2021 is intended to be a stand-alone laundering protocol that can be used for flammability testing. In addition, because AATCC has referenced laundering specifications in several different ways over multiple revisions to TM 124, referencing TM 124 is a less reliable way of incorporating by reference these laundering requirements. In contrast, LP1-2021 is not expected to significantly change the laundering procedures the Commission proposes to incorporate by reference.

Another alternative the Commission considered is allowing both the continued use of the laundering specifications in the Standard (*i.e.*, TM 124-2006) and, as an alternative, the specifications in LP1-2021. The Commission is not proposing that option for several reasons.

For one, when CPSC's washing machines that meet TM 124-2006 reach the end of their useful lives, CPSC will be unable to replace them with machines that meet that specification. At that point, CPSC will be unable to assess compliance with the Standard under TM 124-2006. Moreover, retaining a specification in the regulations that can no longer be met by machines available on the market leaves the regulations outdated. Instead, the Commission highlights 16 CFR 1610.40, which already provides an allowance for firms to use alternative apparatus for testing, under specific conditions. The Commission is facilitating the use of this allowance by providing in this notice and supporting materials the information supporting the use of 16 CFR 1610.40. Alternatively, the Commission could require firms to supply their own supporting information for section 1610.40.

Similarly, the Commission considered amending the Standard to include the specifications in LP1-2021, while allowing for the continued use of TM 124-2006 for a limited phase-out period. The Commission is not proposing this option because it would create the same problems as allowing continued use of TM 124-2006 indefinitely, and staff does not have information about an appropriate phase-out period for machines that comply with TM 124-2006. Although these machines have not been available on the market for many years, some testing laboratories have maintained existing machines, and it is difficult to determine when all such machines will be out of use.

In addition, the Commission considered only updating the washing machine specifications in the Standard, and not the dryer specifications, since only the washing machine specifications can no longer be met my machines available on the market. However, the Commission is proposing to also update the dryer specifications for the reasons discussed above.

Comments. The Commission requests comments on the proposed amendments, including the laundering specifications, comparison testing, use of the allowance in 16 CFR 1610.40, and the justifications for the proposed requirements. The Commission also requests comments on the

alternatives considered and the justifications for them, including the reduced agitation speed, LP1-2021, TM 124-2018, allowing both TM 124-2006 and LP1-2021, providing a phase-out period for TM 124-2006, and the dryer specification. In addition, the Commission seeks information or data regarding the options the Commission has considered, such as how many testing laboratories use washing machines that comply with TM 124-2006, how many such machines testing laboratories use, the expected useful life remaining on these machines, and the extent to which testing laboratories' dryers comply with TM 124-2006 but would not comply with LP1-2021.

IV. Relevant Existing Standards

CPSC staff reviewed and assessed several voluntary and international standards that are relevant to clothing flammability:

- TM 124;
- LP1-2021;
- ASTM D1230-22, Standard Test Method for Flammability of Apparel Textiles; and
- Canadian General Standards Board Standard CAN/CGSB-4.2 No. 27.5, *Textile Test* Method Flame Resistance - 45° Angle Test – One-Second Flame Impingement.

As explained above, TM 124-2006 is currently incorporated by reference into the Standard as part of the laundering requirements, but washing machines that meet this specification are no longer available on the market. The current version, TM 124-2018, includes washing and drying specifications that are the same as LP1-2021. However, TM 124 is not a flammability standard; rather, it is intended to evaluate the smoothness appearance of fabrics after repeated home laundering. As such, it contains provisions that are not relevant to flammability testing and lacks provisions that are necessary for flammability testing.

Similarly, the Commission is proposing to incorporate by reference portions of LP1-2021, but this standard also does not include full flammability testing and classification requirements because it is intended as a stand-alone laundering protocol, for use with other test methods. ASTM D1230 is similar to the Standard but contains similar issues to those this proposed rule aims to address (*e.g.*, same stop thread description as the Standard), and it contains different laundering specifications, terminology, and burn codes. The Canadian standard also is similar to the Standard, but also has some differences (*e.g.*, allows a single Tex size for stop thread).

V. Preliminary Regulatory Analysis

The Commission is proposing to amend a rule under the FFA, which requires that an NPR include a preliminary regulatory analysis. 15 U.S.C. 1193(i). The following discussion is extracted from staff's preliminary regulatory analysis, available in Tab F of the NPR briefing package.

A. Preliminary Description of Potential Costs and Benefits of the Proposed Rule

The preliminary regulatory analysis must include a description of the potential benefits and costs of the proposed rule, including unquantifiable benefits and costs.

1. Potential Benefits

The primary benefit of the proposed amendments is a reduction of burdens for testing laboratories by clarifying existing requirements and updating the specifications for stop thread, dry cleaning, and laundering to include options that are identifiable, permissible for use, and currently available on the market. In addition, the proposed amendments should improve consumer safety. The proposed amendments provide comparable flammability results to the current Standard but would improve testing laboratories' abilities to conduct testing and obtain consistent and reliable results. This should improve consumer safety by ensuring that textiles intended for use in clothing are properly tested and classified so that dangerously flammable textiles are not used in clothing. Staff is unable to quantify these potential benefits because of the difficulty of measuring the extent of testing laboratories' burden reduction and possible improvements to consumer safety. However, staff estimates that these benefits are likely to be small.

Burn Codes. The proposed amendments to burn codes would clarify and streamline these provisions, which staff expects would improve the consistency and reliability of flammability testing results and classifications. This, in turn, may provide some safety benefit to consumers, and reduce testing burdens for testing laboratories. Because these proposed amendments are intended to clarify existing provisions and would not change current requirements for testing or classification, staff expects that they would provide a small amount of unquantifiable benefits.

Stop Thread. The proposed amendments to the stop thread specification would clarify the type of thread required by using the Tex system, which is commonly used and understood by the industry, to define the thread size. The proposed amendments would also expand the range of threads permissible for use under the Standard by providing a range of permissible Tex sizes, rather than specifying a single thread specification, as the current Standard does. As such, the proposed amendments would clarify the requirements, which may have consumer safety benefits by yielding more consistent and reliable test results. However, these benefits are expected to be small since the proposed amendments would provide comparable test results and classifications to the current Standard. The proposed amendments also may ease burdens on testing laboratories, by making it easier to identify compliant thread and by making more threads permissible for use. Therefore, staff expects that these proposed amendments would provide a small amount of unquantifiable benefits.

Dry Cleaning Specification. The proposed amendments to the dry cleaning specification would allow for the continued use of the existing specification using perchloroethylene solvent, and also add an additional specification, as an alternative, to accommodate testing laboratories that will soon be unable to use the solvent currently specified in the Standard. The alternative specification, using hydrocarbon solvent, provides comparable flammability results to the current

solvent specified in the Standard and staff notes that the cost of hydrocarbon solvent is comparable (or lower) in cost than other alternatives. Therefore, staff expects the proposed amendments to reduce burdens on testing laboratories by providing an additional alternative dry cleaning specification and allowing testing laboratories that are subject to restrictions on the use of perchloroethylene to continue to test to the Standard.

Laundering Specification. The proposed amendments to the washing specifications would provide a specification that can be met by machines that are currently on the market. Staff expects that this will reduce burdens on testing laboratories because it would allow testing laboratories that can no longer maintain or obtain washing machines that comply with the Standard to continue to test to the Standard, and it would eliminate their need to maintain and repair older outdated machines. Staff expects the proposed amendments to the drying specifications would provide benefits as well. By requiring the use of the same standard for both washing and drying, these amendments would streamline the requirements for testing laboratories, making it less cumbersome and less costly than obtaining and following two standards. Moreover, LP1-2021 is already familiar to many testing laboratories since it is used for other standards as well; as such, using this standard should be clear and low cost. In addition, by requiring the use of a widely familiar standard for both washing and drying, the proposed amendments should provide for consistent and reliable test results and classifications, and requiring the use of a single standard should reduce the risk of confusion or testing errors from referencing two standards, both of which may have some safety benefits for consumers.

2. Potential Costs

Burn Codes. The proposed amendments regarding burn codes only clarify and streamline existing requirements, and would not change any testing, flammability results, or classification criteria. As such, staff does not expect these proposed amendments to have any notable costs.

Stop Thread. The proposed amendments regarding the stop thread specification clarify and expand the range of permissible threads. They would not change any testing, flammability results, or classification criteria. As staff's testing indicates, thread that meets the current specification in the Standard would comply with the proposed amendments, and the proposed amendments would allow for the use of a wider range of threads than the current Standard. This would allow testing laboratories to continue to use their existing thread or more easily obtain compliant thread by providing a wider range of options. Therefore, staff does not expect these proposed amendments to have any notable costs.

Dry Cleaning Specification. The proposed amendments regarding the dry cleaning specification allow for the continued use of the existing specification (using perchloroethylene solvent), but also provides an additional alternative specification (using hydrocarbon solvent). The proposed amendments would not change any testing requirements or criteria and, as staff's testing demonstrates, the hydrocarbon alternative provides comparable flammability results and classifications to the perchloroethylene specification. As such, testing laboratories could continue to use the existing specification, but would also have an additional option for complying with the Standard. Therefore, staff does not expect these proposed amendments to have any notable costs.

Laundering Specification. The proposed amendments regarding the washing specification would require different washing machines than those that currently comply with the Standard, since those machines are no longer available on the market. However, firms have the option to continue using machines that comply with the current Standard under 16 CFR 1610.40, thereby avoiding the need to obtain new washing machines. In this notice, the Commission preliminary concludes that, for purposes of 16 CFR 1610.40, the testing CPSC staff conducted that is provided in this notice and in full detail in Tabs D and E of the briefing package supporting this proposed rule constitutes information demonstrating that the washing procedure specified in the current Standard is as stringent as the washing procedure in LP1-2021 that is proposed to be

required in this NPR. Therefore, if firms rely on this information and conform to the other requirements in section 1610.40, this will provide an option for them to continue to use washing machines that comply with the provisions in TM 124-2006 in the current Standard. This alternative would impose no costs, as testing laboratories could continue to use their existing compliant machines.

Although staff does not expect the proposed amendments to the washing specifications to impose any costs, staff examined potential costs associated with obtaining machines that comply with the proposed amendments to assess the costs to firms that choose to do so, rather than continue to use existing machines in accordance with the allowance in 16 CFR 1610.40. One potential cost to firms that choose to obtain new machines would be the cost of buying a copy of LP1-2021, which is approximately \$50 for AATCC members and \$70 for non-members. Staff does not consider this a significant cost and firms will not incur this cost if they already have LP1-2021 to comply with other standards.

The primary cost to firms that choose to obtain new machines would be the cost of new washing machines that comply with LP1-2021. Staff estimates that these machines cost an average of \$4,300 (excluding tax but including certified calibration, packaging, and shipping). However, this cost would be offset by the reduced costs of no longer needing to repair or maintain existing, outdated machines. Staff estimates that the cost of maintaining and repairing the outdated machines is \$300 annually and assumes that if a laboratory chooses to upgrade machines, it expects to receive benefits from the upgrade that outweigh the acquisition costs.

Staff was unable to determine the number of testing laboratories that test to the Standard and that would, therefore, by subject to the proposed amendments. At a minimum, staff notes that there currently are more than 300 testing laboratories that are CPSC-accepted third party laboratories that test to the Standard for purposes of children's product certifications. However, that is an underestimate of the number of firms impacted by the proposed rule because testing

laboratories need not be CPSC-accepted third party laboratories to test to the Standard for nonchildren's products. At a maximum, staff notes that there are a total of 7,389 testing laboratories in the United States, according to the Census Bureau. However, this is an overestimate of the number of firms in the United States impacted by the proposed rule because this number includes testing laboratories that do not test to the Standard. Staff estimates that each testing laboratory that tests to the Standard has three washing machines that do not meet LP1-2021.

The proposed amendments regarding the drying specification are unlikely to require different dryers than those that currently comply with the Standard, since most dryers can comply with both specifications. However, to the extent that dryers that meet the current Standard would not meet the proposed amendments, firms would again have the option to continue to use their existing compliant dryers in accordance with 16 CFR 1610.40. Therefore, this alternative would eliminate any potential costs associated with the proposed amendments. Moreover, because most dryers comply with both the current Standard and LP1-2021, staff does not expect that most firms would need to replace their dryers even if they chose to comply with LP1-2021, instead of using 16 CFR 1610.40 to continue to comply with TM 124-2006.

B. Reasons for Not Relying on a Voluntary Standard

When the Commission issues an ANPR under the FFA, it must invite interested parties to submit existing standards or provide a statement of intention to modify or develop a standard that would address the hazard at issue. 15 U.S.C. 1193(g). When CPSC receives such standards or statements in response to an ANPR, the preliminary regulatory analysis must provide reasons that the proposed rule does not include such standards. *Id.* 1193(i). In the present rulemaking, the Commission did not issue an ANPR. Accordingly, CPSC did not receive submissions of standards or statements of intention to develop standards regarding clothing flammability.

C. Alternatives to the Proposed Rule

A preliminary regulatory analysis must describe reasonable alternatives to the proposed rule, their potential costs and benefits, and a brief explanation of the reasons the alternatives were not chosen. 15 U.S.C. 1193(i). CPSC considered several alternatives to the proposed rule. These alternatives, their potential costs and benefits, and the reasons the Commission did not select them, are described in detail in section **VI. Alternatives to the Proposed Rule**, below, and Tab F of the NPR briefing package.

VI. Alternatives to the Proposed Rule

Burn Codes. CPSC could retain the current burn code provisions in the Standard, rather than updating them. This alternative would not create any costs, but also would not provide any benefits. In comparison, the proposed amendments also would not create any costs, but would have benefits. Based on staff's assessment of needed clarifications, and comments on the RFI indicating the need for these clarifications, CPSC did not select this option.

Stop Thread Specification. As one alternative, CPSC could update the stop thread specification to require the use of a stop thread with the specific Tex size of the thread currently required in the Standard. This would not create any costs since thread that meets the current Standard would meet this alternative. However, this alternative would be more restrictive than the proposed amendment by providing fewer options of stop threads. Because staff determined that the range of Tex sizes in the proposed amendment would provide comparable flammability results to the Standard, while providing a broader range of options, CPSC did not select this alternative.

Another alternative is to allow a wider range of Tex sizes, such as the full range staff assessed during flammability testing and found to yield comparable flammability results to the Standard. This would further reduce burdens on testing laboratories by providing even more options. However, staff concluded that it is more appropriate to limit the range of Tex sizes to those of cotton threads that yielded comparable flammability results to the Standard because some polyester threads are designed to be flame resistant.

Dry Cleaning Specification. In addition to the hydrocarbon alternative proposed in this NPR, CPSC considered two additional dry cleaning specifications—silicone, and butylal. As staff's testing indicates, both of these alternatives also yield comparable flammability results to the current Standard and, therefore, are likely to offer similar benefits to the hydrocarbon specification proposed. Staff identified estimated costs of the four dry cleaning solvent specifications using comparisons provided by the Toxic Use Reduction Institute (TURI). These comparisons estimate that dry cleaning with perchloroethylene involves equipment costs between \$40,000 and \$65,000 and solvent costs of \$17; dry cleaning with hydrocarbon involves equipment costs between \$38,000 and \$75,000 and solvent costs of \$14 to \$17; dry cleaning with silicone involves equipment costs between \$30,500 and \$55,000 and solvent costs of \$22 to \$28; and dry cleaning with butylal involves equipment costs between \$50,000 and \$100,000 and solvent costs of \$28 to \$34. CPSC did not select the silicone or butylal alternatives because butylal yielded slightly more different classifications than the current Standard during comparison testing; hydrocarbon is the most commonly used alternative to perchloroethylene; hydrocarbon has a long history of use; and several companies manufacture hydrocarbon solvents for dry cleaning, whereas silicone and butylal are newer technologies and patented, making their availability more limited.

CPSC also considered requiring the use of only the hydrocarbon specification, rather than continuing to allow the use of the perchloroethylene specification in the current Standard. However, this alternative may increase costs by requiring all testing laboratories to change their dry cleaning specifications. CPSC did not select this option because, although perchloroethylene

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is being restricted in some locations, it is still available and widely used in the dry cleaning industry.

Laundering Specification. In addition to the LP1-2021 alternative proposed in this NPR, CPSC considered an alternative of continuing to require compliance with the laundering specification in TM 124-2006, but with a reduced agitation speed. As staff's testing indicates, this alternative also yields comparable flammability results to the current Standard and, therefore, is likely to offer similar benefits to the LP1-2021 specification proposed. However, this alternative may have higher costs than the proposed amendment because laboratory-grade washing machines are not sold pre-programmed to the reduced agitation speed settings, but they are sold pre-programmed with the LP1-2021 settings. Consequently, additional time and skilled labor resources would be necessary to program machines to meet the reduced agitation speed alternative, and there would be the potential for testing errors. CPSC did not select this option because testing laboratories are likely to already have and be familiar with LP1-2021 and have machines that comply with it since it is required for other standards and there are more washing machines on the market that meet the specifications in LP1-2021 than the reduced agitation speed parameters.

CPSC also considered amending the Standard to allow the use of LP1-2021 specifications or TM 124-2006 specifications. Similarly, CPSC considered amending the Standard to include the specifications in LP1-2021, while allowing for the continued use of TM 124-2006 for a limited phase-out period. These alternatives would have minimal, if any, costs because they would allow testing laboratories to continue to use existing machines, while providing an option to obtain machines that are available on the market. CPSC did not select these options because this would leave CPSC unable to test for compliance in accordance with one of the procedures in the Standard when CPSC's TM 124-2006-compliance machines reach the end of their useful lives; this would retain in the Standard an outdated and obsolete specification that is no longer

possible to meet with products available on the market; and staff does not have information about an appropriate phase-out period for machines that comply with TM 124-2006.

Although the CPSC did not select either of these alternatives, firms would still be able to continue to use TM 124-2006-compliant machines, instead of LP1-2021-compliant machines, under the provisions in 16 CFR 1610.40. The Commission is facilitating this option by providing, in this notice and the briefing package supporting it, the documentation necessary to support that alternative.

For dryers, CPSC considered retaining the current provisions in the Standard, which reference TM 124-2006, since dryers that meet this standard are still available on the market. This alternative would eliminate any costs associated with the proposed amendment to dryer specifications. CPSC did not select this option because requiring the use of a single standard ensures compatible washing and drying requirements and reduces confusion and costs associated with obtaining and following two separate standards. In addition, because the dryer specifications in TM 124-2006 and LP1-2021 are nearly identical, testing laboratories are unlikely to need to replace their dryers to meet the proposed amendments and, for those that do, the allowance in 16 CFR 1610.40 would mitigate or eliminate that need.

VII. Paperwork Reduction Act

This proposed rule does not involve any new information collection requirements, subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501-3521). The Standard does contain recordkeeping provisions, but this proposed rule would not alter the estimated burden hours to establish or maintain associated records from the information collection approved previously.³⁴

VIII. Regulatory Flexibility Act Analysis³⁵

When an agency is required to publish a proposed rule, section 603 of the Regulatory Flexibility Act (5 U.S.C. 601-612) requires that the agency prepare an initial regulatory flexibility analysis (IRFA), containing specific content, that describes the impact that the rule would have on small businesses and other entities. 5 U.S.C. 603(a). However, an IRFA is not required if the head of the agency certifies that the rule "will not, if promulgated, have a significant economic impact on a substantial number of small entities." 5 U.S.C. 603, 605(b). The agency must publish the certification in the *Federal Register* along with the NPR or final rule, include the factual basis for the certification, and provide the certification and statement to the Chief Counsel for Advocacy of the Small Business Administration. *Id*.³⁶

The Commission certifies that the proposed amendments, if adopted, will not have a significant economic impact on a substantial number of small entities. This is because there are little to no estimated costs associated with the rule since the proposed amendments reduce burdens on industry, maintain or expand existing requirements, or firms may rely on the allowance in 16 CFR 1610.40 to continue to use equipment that is being updated in the proposed amendments. The factual basis for the certification for this proposed rule is available in Tab F of the NPR briefing package; this section provides an overview.

A. Small Entities to Which the Rule Would Apply

The proposed rule would amend requirements for testing laboratories that test for compliance with the Standard. According to the small business size standards set by the Small Business Administration, testing laboratories are considered small if their average annual

³⁶ For additional details regarding certifications, see A Guide for Government Agencies: How to Comply with the Regulatory Flexibility Act, SBA Office of Advocacy (Aug. 2017), available at: https://advocacy.sba.gov/2017/08/31/a-guide-for-government-agencies-how-to-comply-with-the-regulatory-flexibility-act/. CLEARED FOR PUBLIC RELEASE UNDER CPSA 6(b)(1). REVIEWED OR ACCEPTED BY THE COMMISSION.

³⁵ For additional information regarding the Regulatory Flexibility Act analysis, see Tab F of the briefing package supporting this NPR.

receipts are less than \$16.5 million per year. Staff estimates that 70 percent of testing laboratories would be considered small.

Staff identified a possible minimum and maximum number of testing laboratories that would be subject to the rule, but notes that the upper and lower bounds of these estimates are unlikely to represent the number of impacted firms. As explained above, at a minimum, there currently are more than 300 testing laboratories that are CPSC-accepted third party laboratories that test to the Standard for purposes of children's product certifications. However, this is an underestimate of the number of firms impacted by the proposed rule because this number only includes testing laboratories that test to the Standard for children's products. Using this minimum estimate and the assumption that 70 percent are small firms, there are a minimum of 210 CPSCaccepted third party laboratories that qualify as small businesses. To identify a possible maximum, staff determined that there are a total of 7.389 testing laboratories in the United States, according to the Census Bureau. However, this is an overestimate of the number of firms impacted by the proposed rule because this number includes testing laboratories that do not test to the Standard. Using this maximum estimate and the assumption that 70 percent are small firms, there are a maximum of 5,172 small testing laboratories could theoretically be impacted by the proposed rule.

B. Criteria Supporting Certification

In considering whether certification is justified, staff established criteria for what constitutes a "significant economic impact" and a "substantial number." Staff determined that a reasonable threshold for a "significant economic impact" is costs in excess of 1 percent of the

small firm's gross annual revenue, and a "substantial number" is 20 percent or more of small domestic firms.

C. Potential Economic Impacts on Small Entities

The estimated economic impacts of the proposed rule are the same for small entities as for all firms and are discussed in section **V**. **Preliminary Regulatory Analysis** of this notice.

Staff does not anticipate any significant costs associated with the proposed amendments regarding burn codes because these amendments would merely clarify existing requirements. Staff does not anticipate any significant costs associated with the proposed amendments regarding stop thread or dry cleaning specifications because these amendments would continue to allow the use thread and dry cleaning under the current Standard. Staff also does not anticipate any significant costs associated with the proposed amendments regarding drying specifications because most dryers comply with both the current drying specifications and the proposed amendments, and any machines that do not comply with the amendments could be addressed through the allowance in 16 CFR 1610.40.

As discussed in the preliminary regulatory analysis, staff also does not expect significant costs associated with the proposed amendments regarding washing specifications because firms could continue to use existing machines under the allowance in 16 CFR part 1610.40. In addition, any economic impact of these amendments on small firms would be offset by reducing the repair and maintenance costs to these firms to continue to use outdated machines required in the current Standard. Therefore, because there is no expected cost associated with the proposed rule, the economic impact is expected to be lower than the thresholds for "significant economic impact" and "substantial number."

However, even if small firms choose to obtain new laundering machines, rather than continue to use existing machines under the allowance in 16 CFR 1610.40, staff expects these incremental costs to be well below 1 percent of the annual revenue of a small firm. Among

domestic CPSC-accepted testing laboratories that are considered small and for which data was available, the average gross annual revenue was \$2,930,192. As such, a cost would only be a "significant economic impact" if it totaled more than \$29,301 (*i.e.*, 1 percent of the small firm's gross annual revenue). Staff estimates that acquiring a washing machine that complies with LP1-2021 is \$4,300, minus \$300 for the cost of maintaining a washing machine that complies with TM 124-2006, for a total incremental cost of \$4,000. Staff assumes that testing laboratories each have three washing machines to test to the Standard. Thus, even replacing all three washing machines would result in a total cost of approximately \$12,000 and would not constitute a "significant economic impact" for small entities. Staff does not expect all small entities to replace their washing machines, as some may use the allowance in 16 CFR 1610.40 to continue to use their existing machines. As such, a "substantial number" of small entities would not have significant economic impacts, even if they choose to upgrade their machines.

D. Assumptions and Uncertainties

Assumptions and uncertainties regarding the number of small entities affected by the proposed rule are discussed above. Assumptions and uncertainties regarding staff's assessment of the impact of the rule on small entities are described in section **V. Preliminary Regulatory Analysis** of this notice.

E. Request for Comments

The Commission requests comments on the certification, the factual basis for it, the threshold economic analysis, and the underlying assumptions and uncertainties.

IX. Incorporation by Reference

The proposed rule incorporates by reference LP1-2021. The Office of the Federal Register (OFR) has regulations regarding incorporation by reference. 1 CFR part 51. Under these regulations, in the preamble of the NPR, an agency must summarize the incorporated material, and discuss the ways in which the material is reasonably available to interested parties or how

the agency worked to make the materials reasonably available. 1 CFR 51.5(a). In accordance with the OFR requirements, this preamble summarizes the provisions of LP1-2021 that the Commission proposes to incorporate by reference.

The standard is reasonably available to interested parties and interested parties can purchase a copy of LP1-2021 from the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, North Carolina 27709; telephone (919) 549-8141; www.aatcc.org. Additionally, during the NPR comment period, a copy of LP1-2021 is available for viewing on AATCC's website at: https://members.aatcc.org/store/lp001/2212/. Once a final rule takes effect, a read-only copy of the standard will be available for viewing on the AATCC website. Interested parties can also schedule an appointment to inspect a copy of the standard at CPSC's Office of the Secretary, U.S. Consumer Product Safety Commission, 4330 East West Highway, Bethesda, MD 20814, telephone: 301-504-7479; e-mail: cpsc-os@cpsc.gov.

X. Testing, Certification, and Notice of Requirements

Because the Standard applies to clothing and textiles intended to be used for clothing, it applies to both non-children's products and children's products. Section 14(a) of the Consumer Product Safety Act (CPSA; 15 U.S.C. 2051-2089) includes requirements for testing and certifying that non-children's products and children's products comply with applicable mandatory standards issued under any statute the Commission administers, including the FFA. 15 U.S.C. 2063(a). The Commission's regulations on certificates of compliance are codified at 16 CFR part 1110.

Section 14(a)(1) addresses required testing and certifications for non-children's products and requires every manufacturer of a non-children's product, which includes the importer,³⁷ that is subject to a rule enforced by the Commission and imported for consumption or warehousing or distributed in commerce, to issue a certificate. The manufacturer must certify, based on a test of each product or upon a reasonable testing program, that the product complies with all rules, bans, standards, or regulations applicable to the product under statutes enforced by the Commission. The certificate must specify each such rule, ban, standard, or regulation that applies to the product. 15 U.S.C. 2063(a)(1).

Sections 14(a)(2) and (a)(3) address testing and certification requirements specific to children's products. A "children's product" is a consumer product that is "designed or intended primarily for children 12 years of age or younger." 15 U.S.C. 2052(a)(2). The CPSA and CPSC's regulations provide factors to consider when determining whether a product is a children's product. 15 U.S.C. 2052(a)(2); 16 CFR 1200.2. An accredited third party conformity assessment body (third-party lab) must test any product that is subject to a children's product safety rule³⁸ for compliance with the applicable rule. 15 U.S.C. 2063(a)(2)(A). After this testing, the manufacturer or private labeler of the product must certify that, based on the third-party lab's testing, the product complies with the children's product safety rule. *Id*. 2063(a)(2)(B).

The Commission must publish a notice of requirements (NOR) for third-party labs to obtain accreditation to assess conformity with a children's product safety rule. *Id.* 2063(a)(3)(A). The Commission must publish an NOR for new or revised children's products standards not later than 90 days before such rules or revisions take effect. *Id.* 2063(a)(3)(B)(vi). The Commission previously published an NOR for the Standard.³⁹ The NOR provided the criteria and process for CPSC to accept accreditation of third-party labs for testing products to 16 CFR part 1610. Part 1112 provides requirements for third-party labs to obtain accreditation to test for conformance with a children's product safety rule, including the Standard. 16 CFR 1112.15(b)(20).

³⁸ The Commission has previously stated that because the definition of "children's product safety rule" in section 14(f)(1) of the CPSA includes any consumer product safety rule issued under any statute enforced by the Commission, third-party testing is required to support a certification under the Standard since the Standard applies to children's products as well as non-children's products. *See* 77 FR 31086, 31105 (May 24, 2012).
 ³⁹ See 75 FR 51016 (Aug. 18, 2010), amended at 76 FR 22608 (Apr. 22, 2011); 78 FR 15836 (Mar. 12, 2013). THIS DOCUMENT HAS NOT BEEN CLEARED FOR PUBLIC RELEASE UNDER CPSA 6(b)(1). REVIEWED OR ACCEPTED BY THE COMMISSION.

The proposed rule does not require third-party labs to change the way they test products for compliance with the Standard. The proposed amendments to burn codes do not alter test protocols; they merely clarity existing requirements. The proposed amendments regarding stop thread and dry cleaning specifications continue to allow the use of the specifications that comply with the current Standard. Although the proposed amendments regarding laundering specifications differ from the current Standard, 16 CFR 1610.40 provides an allowance for the continued use of laundering specifications under the current Standard. Accordingly, if the Commission issues a final rule, the existing accreditations that the Commission has accepted for testing to the Standard would cover testing to the revised Standard, and CPSC-accepted third party conformity assessment bodies would be expected to update the scope of their accreditations to reflect the revised Standard in the normal course of renewing their accreditations. Accordingly, the Commission does not propose to revise the NOR for testing to the Standard.

The Commission seeks comments on this assessment and implications of the proposed rule on testing and certifications.

XI. Environmental Considerations

The Commission's regulations address whether CPSC is required to prepare an environmental assessment (EA) or an environmental impact statement (EIS). 16 CFR 1021.5. Those regulations list CPSC actions that "normally have little or no potential for affecting the human environment," and, therefore, fall within a "categorical exclusion" under the National Environmental Policy Act (42 U.S.C. 4231-4370h) and the regulations implementing it (40 CFR parts 1500-1508) and do not require an EA or EIS. 16 CFR 1021.5(c). Among those actions are rules that provide design or performance requirements for products, or revisions to such rules. *Id.* 1021.5(c)(1). Because this proposed rule would make minimal revisions to the equipment and
materials used for flammability testing in the Standard, and make minor revisions for clarity, the proposed rule falls within the categorical exclusion, and thus, no EA or EIS is required.

XII. Preemption

Executive Order (EO) 12988, *Civil Justice Reform* (Feb. 5, 1996), directs agencies to specify the preemptive effect of a regulation. 61 Fed. Reg. 4729 (Feb. 7, 1996), section 3(b)(2)(A). In accordance with EO 12988, CPSC states the preemptive effect of the proposed rule, as follows:

The proposed revision to the Standard for the Flammability of Clothing Textiles falls under the authority of the FFA. Section 16 of the FAA provides that "whenever a flammability standard or other regulation for a fabric, related material, or product is in effect under this Act, no State or political subdivision of a State may establish or continue in effect a flammability standard or other regulation for such fabric, related material or product if the standard or other regulation is designed to protect against the same risk of occurrence of fire with respect to which the standard or other regulation under this Act is in effect unless the State or political subdivision standard or other regulation is identical to the Federal standard or other regulation." 15 U.S.C. 1203(a). The federal government, or a state or local government, may establish or continue in effect a non-identical requirement for its own use that is designed to protect against the same risk as the CPSC standard if the federal, state, or local requirement provides a higher degree of protection than the CPSC requirement. Id. 1203(b). In addition, states or political subdivisions of a state may apply for an exemption from preemption regarding a flammability standard or other regulation applicable to a fabric, related material, or product subject to a standard or other regulation in effect under the FFA. Upon such application, the Commission may issue a rule granting the exemption if it finds that: (1) compliance with the state or local standard would not cause the fabric, related material, or product to violate the federal standard; (2) the state or local standard provides a significantly higher degree of protection from the risk of occurrence of fire

than the CPSC standard; and (3) the state or local standard does not unduly burden interstate commerce. *Id.* 1203(c).

XIII. Effective Date

Section 4(b) of the FFA specifies that an amendment to a flammability standard shall take effect 12 months after the date the amendment is promulgated unless the Commission finds, for good cause shown, that an earlier or later effective date is in the public interest and publishes the reasons for that finding. 15 U.S.C. 1193(b).

The Commission proposes that the amendments to the Standard take effect 6 months after publication of the final rule in the **Federal Register**. However, the Commission seeks comments on whether a different effective date is justified and, if so, the appropriate date and justification for it. The Commission preliminarily finds that this shorter effective date is in the public interest because the Standard provides an important safety benefit and the proposed amendments would provide some improvement to those benefits, with little to no costs. Moreover, a shorter effective date is justified given that the proposed amendments should have minimal impacts, improve clarity, and relieve burdens; that the prohibition on the use of perchloroethylene in dry cleaning in California will take effect in January 2023; and that washing machines that meet the Standard are no longer available.

Section 4(b) of the FFA also requires that an amendment of a flammability standard exempt fabrics, related materials, and products "in inventory or with the trade" on the date the amendment becomes effective, unless the Commission prescribes, limits, or withdraws that exemption because it finds that the product is "so highly flammable as to be dangerous when used by consumers for the purpose for which it is intended." Because the proposed amendments are intended to have minimal impacts, the Commission proposes that products "in inventory or with the trade" on the date the amendment becomes effective be exempt from the amended Standard.

XIV. Proposed Findings

As discussed in section **II. Statutory Provisions**, above, the FFA requires the Commission to make certain findings when it issues or amends a flammability standard. 15 U.S.C. 1193(b), (j)(2). This section discusses preliminary support for those findings.

The amendments are needed to adequately protect the public against unreasonable risk of fire leading to death, injury, or significant property damage. Since the requirements in the Standard were promulgated in 1953, industry practices, equipment, materials, and procedures have evolved, making some parts of the Standard outdated, unavailable, or unclear. Because the Standard determines whether a fabric is safe for use in clothing, it is necessary to replace outdated and unavailable equipment, materials, and procedures and clarify unclear provisions, to ensure that flammability testing can be performed and that the results of the testing yield consistent, reliable, and accurate flammability classifications to ensure that dangerously flammable fabrics are not used in clothing.

The amendments are reasonable, technologically practicable, and appropriate, and are stated in objective terms. The amendments reflect clarifications that industry members requested, streamline existing requirements, and update outdated equipment, materials, and procedures. The proposed amendments reflect changes recommended by industry members, and allow for the use of equipment, materials, and procedures that are commonly used by industry members, recognized in standards developed by industry, and are readily available, and stated in objective terms.

The amendments are limited to fabrics, related materials, and products that present an *unreasonable risk*. The proposed amendments do not alter the textiles or products that are subject to the Standard, which addresses products that present an unreasonable risk.

Voluntary standards. CPSC identified four relevant voluntary standards. AATCC Test Method 124-2018, *Appearance of Fabrics after Repeated Home Laundering*, includes provisions

that are relevant to flammability testing and is similar to portions of the Standard, but is not a flammability standard. Rather, it is intended to evaluate the smoothness appearance of fabrics after repeated home laundering. As such, it contains provisions that are not relevant to flammability testing and lacks provisions that are necessary for flammability testing. AATCC's Laboratory Procedure 1-2021, Home Laundering: Machine Washing, also includes provisions that are relevant to flammability testing and is similar to portions of the Standard but is not a flammability standard. Rather, it is intended as a stand-alone laundering protocol, for use with other test methods, such as a flammability standard. Therefore, it contains provisions that are not relevant to flammability testing and lacks provisions that are necessary for flammability testing. ASTM D1230-22, Standard Test Method for Flammability of Apparel Textiles, is similar to the Standard, but contains different laundering specifications, terminology, and burn codes, and it does not address issues identified in this proposed rule, such as clarification of the stop thread specification. Canadian General Standards Board Standard CAN/CGSB-4.2 No. 27.5, Textile *Test Method Flame Resistance - 45° Angle Test – One-Second Flame Impingement*, also is similar to the Standard, but includes several differences from longstanding provisions in the Standard, such as stop thread specifications. Compliance with these voluntary standards is not likely to result in the elimination or adequate reduction of the risk of injury identified by the Commission. The proposed amendments will provide better clarity and updates than these voluntary standards and, therefore, better address the risk of injury.

Relationship of benefits to costs. Because the proposed amendments reflect current industry practices and provide needed clarifications, the anticipated benefits and costs are expected to be small and bear a reasonable relationship to each other.

Least burdensome requirement. The proposed amendments do not substantively change the Standard but provide changes that are necessary for clarity and so that testing laboratories may obtain necessary materials and equipment to conduct testing. Several proposed amendments

expand the permissible range of materials or equipment to reduce burdens. For revisions that include new equipment or materials, the proposed amendments either provide these new equipment and materials as additional alternatives, or the Commission provides information to support the continued use of equipment or materials in the current Standard under 16 CFR 1610.40.

XV. Request for Comments

The Commission requests comments on all aspects of the proposed rule. Comments should be submitted in accordance with the instructions in the **ADDRESSES** section at the beginning of this notice. The following are specific comment topics that the Commission would find particularly helpful:

- Burn Codes:
 - The proposed amendments to the test result code provisions, whether they improve clarity, and whether additional revisions are necessary;
- Stop Thread:
 - The proposed revisions to the stop thread specification and whether additional revisions are necessary and why;
 - The equivalency of the proposed revisions and information and data supporting such comments;
 - The use of Tex size as part of the stop thread specification, as well as the appropriate size and range and justifications for them;
 - Alternatives to the proposed revisions, along with information and data supporting them;
- Comparison Testing:
 - The comparison testing supporting this NPR, including the fabrics selected, test methods, results, and conclusions regarding comparability to the Standard;

- Dry Cleaning Specifications:
 - The proposed revisions to the dry cleaning specifications;
 - The equivalency of the proposed revisions and information and data supporting such comments;
 - Whether perchloroethylene should be retained as an option in the Standard;
 - Whether hydrocarbon solvent should be the alternative provided, or whether other options should be provided instead of or in addition to hydrocarbon and, if so, information, data, and justifications for doing so;
- Washing Specifications:
 - The proposed revisions to the washing specifications;
 - The equivalency of the proposed revisions and information and data supporting such comments;
 - Whether TM 124-2006 should be retained as an option in the Standard and, if so, for how long and the justifications for doing so;
 - Additional alternatives, including reduced agitation speed and TM 124-2018, and other appropriate alternatives, along with information, data, and justifications for such alternatives;
 - The allowance in 16 CFR part 1610.40 and its utility for the continued use of washing specifications required in the current Standard;
- Drying Specifications:
 - The proposed revisions to the drying specifications;
 - The equivalency of the proposed revisions and information and data supporting such comments;
 - \circ Whether TM 124-2006 should be retained as an option in the Standard and, if so,

for how long and the justifications for doing so;

- Additional alternatives, including TM 124-2018 or the use of different standards for washing and drying, and other appropriate alternatives, along with information, data, and justifications for such alternatives;
- The allowance in 16 CFR part 1610.40 and its utility for the continued use of drying specifications required in the current Standard;
- Effective Date:
 - The reasonableness of the proposed effective date, and recommendations and justifications for a different effective date;
 - The reasonableness of the proposed effective date for the amendments regarding burn codes and stop thread, and whether another effective date would be in the public interest, and why;
 - The reasonableness of the proposed effective date for the amendments regarding dry cleaning, and whether a shorter effective date would be in the public interest, particularly given the prohibition on the use of perchloroethylene in certain locations, beginning in 2023;
 - The reasonableness of the proposed effective date for the amendments regarding laundering, including whether labs will need to obtain new machines and the time needed to obtain and test with new machines;
- Economic Analyses:
 - The accuracy of the estimated benefits associated with the proposed rule, and whether additional benefits should be considered, particularly for testing laboratories that are affected by restrictions on dry cleaning and the market availability of laundering equipment;

- The accuracy of the estimated costs associated with the proposed rule, and whether additional costs should be considered, particularly for testing laboratories that maintain, use, or need new laundering equipment to test to the Standard;
- Information and data regarding the benefits and costs associated with the proposed rule;
- The number of firms that would be impacted by the proposed rule and the extent to which they would be impacted;
- The number of small entities that would be impacted by the proposed rule and the benefits and costs to them; and
- The alternatives to the proposed rule and the benefits and costs associated with them.

Consistent with the FFA requirement to provide interested parties with an opportunity to make oral presentations of data, views, or arguments, the Commission requests that anyone who would like to make an oral presentation concerning this rulemaking contact CPSC's Office of the Secretary (contact information is provided in the **ADDRESSES** section of this notice) within 45 days of publication of this notice. If the Commission receives requests to make oral comments, a date will be set for a public meeting for that purpose and notice of the meeting will be provided in the **Federal Register**.

XVI. Conclusion

For the reasons stated in this preamble, the Commission proposes to amend the Standard for the Flammability of Clothing Textiles.

List of Subjects

16 CFR Part 1610

Clothing, Consumer protection, Flammable materials, Reporting and recordkeeping requirements, Textiles, Warranties.

For the reasons discussed in the preamble, the Commission proposes to amend Title 16 of the Code of Federal Regulations by revising part 1610 to read as follows:

PART 1610—STANDARD FOR THE FLAMMABILITY OF CLOTHING TEXTILES

1. The authority citation for part 1610 continues to read as follows:

Authority: 15 U.S.C. 1191-1204.

2. Amend § 1610.2 by revising paragraphs (a) and (p) to read as follows:

§ 1610.2 Definitions.

* * * * *

(a) *Base burn* (also known as base fabric ignition or fusing) means the point at which the flame burns the ground (base) fabric of a raised surface textile fabric and provides a self-sustaining flame. Base burns, used to establish a Class 2 or 3 fabric, are those burns resulting from surface flash that occur on specimens in places other than the point of impingement (test result code SFBB) when the warp and fill yarns of a raised surface textile fabric undergo combustion. Base burns can be identified by an opacity change, scorching on the reverse side of the fabric, or when a physical hole is evident.

* * * * *

(p) *Stop thread supply* means 3-ply, white, mercerized, 100% cotton sewing thread, with a Tex size of 35 to 45.

3. Amend § 1610.4 by revising paragraphs (a)(2), (b)(2), (c)(2), and Table 1 to read as follows:

§ 1610.4 Requirements for classifying textiles.

(a) * * *

(2) *Raised surface textile fabric*. Such textiles in their original state and/or after being refurbished as described in § 1610.6(a) and § 1610.6(b), when tested as described in § 1610.6, shall be classified as Class 1, Normal flammability, when the burn time is more than 7.0 seconds,

or when they burn with a rapid surface flash (0.0 to 7.0 seconds), provided the intensity of the flame is so low as not to ignite or fuse the base fabric.

(b) * * *

(2) *Raised surface textile fabric*. Such textiles in their original state and/or after being refurbished as described in § 1610.6(a) and § 1610.6(b), when tested as described in § 1610.6, shall be classified as Class 2, Intermediate flammability, when the burn time is from 4.0 through 7.0 seconds, both inclusive, and the base fabric starts burning at places other than the point of impingement as a result of the surface flash (test result code SFBB).

(c) * * *

(2) *Raised surface textile fabric*. Such textiles in their original state and/or after refurbishing as described in § 1610.6(a) and § 1610.6(b), when tested as described in § 1610.6, shall be classified as Class 3 Rapid and Intense Burning when the time of flame spread is less than 4.0 seconds, and the base fabric starts burning at places other than the point of impingement as a result of the surface flash (test result code SFBB).

Table 1 to § 1610.4 - Summary of Test Criteria for Specimen Classification

[See § 1610.7]

Class	Plain surface textile fabric	Raised surface textile fabric
1	Burn time is 3.5 seconds or more.	(1) Burn time is greater than 7.0 seconds; or
	ACCEPTABLE (3.5 seconds is a	(2) Burn time is less than or equal to 7.0 seconds with
	pass)	no SFBB test result code. Exhibits rapid surface flash
		only.
		ACCEPTABLE – Normal Flammability
2	Class 2 is not applicable to plain	Burn time is 4.0 to 7.0 seconds (inclusive) with base
	surface textile fabrics.	burn (SFBB).
		ACCEPTABLE – Intermediate Flammability
3	Burn time is less than 3.5 seconds.	Burn time is less than 4.0 seconds with base burn
	NOT ACCEPTABLE	(SFBB).
		NOT ACCEPTABLE – Rapid and Intense Burning

Note: SFBB poi and SFBB poi* are not considered a base burn for determining Class 2 and 3 fabrics.

4. Amend § 1610.5 by revising paragraphs (a)(2)(ii), (b)(6), and (b)(7) to read as follows:

§ 1610.5 Test apparatus and materials.

(1) * * *

(2) * * *

(i) * * *

(ii) *Stop thread supply*. This supply, consisting of a spool of 3-ply, white, mercerized, 100% cotton sewing thread, with a Tex size of 35 to 45 Tex, shall be fastened to the side of the chamber and can be withdrawn by releasing the thumbscrew holding it in position.

* * * * *

(b) * * *

(6) *Commercial dry cleaning machine.* The commercial dry cleaning machine shall be capable of providing a complete automatic dry-to-dry cycle using perchloroethylene solvent or hydrocarbon solvent and a cationic dry cleaning detergent as specified in § 1610.6(b)(1)(i).

(7) *Dry cleaning solvent.* The solvent shall be perchloroethylene, commercial grade, or hydrocarbon solvent, commercial grade.

* * * * *

5. Amend § 1610.6 by revising paragraphs (b)(1)(i)(A), (b)(1)(ii), and (b)(1)(iii) to read as follows:

§ 1610.6 Test procedure.

* * * * *

(b) * * *
(1) * * *
(i) * * *

(A) All samples shall be dry cleaned before they undergo the laundering procedure.Samples shall be dry cleaned in a commercial dry cleaning machine, using one of the following prescribed conditions:

(1) Solvent: Perchloroethylene, commercial grade.

Detergent class: Cationic.

Cleaning time: 10-15 minutes.

Extraction time: 3 minutes.

Drying Temperature: 60-66°C (140-150°F).

Drying Time: 18-20 minutes.

Cool Down/Deodorization time: 5 minutes.

(2) Solvent: Hydrocarbon.

Detergent Class: Cationic.

Cleaning Time: 20-25 minutes.

Extraction Time: 4 minutes.

Drying Temperature: 60-66°C (140-150°F).

Drying Time: 20-25 minutes.

Cool Down/Deodorization Time: 5 minutes.

Samples shall be dry cleaned in a load that is 80% of the machine's capacity.

(B) * * *

(ii) *Laundering procedure*. The sample, after being subjected to the dry cleaning procedure, shall be washed and dried one time in accordance with section 9.2, section 9.4, section 12.2(A), Table I "(1) Normal," "(IV) Hot," and Table VI "(Aiii) Permanent Press" of AATCC LP1-2021, "Laboratory Procedure for Home Laundering: Machine Washing" (incorporated by reference, see § 1610.6(b)(1)(iii)). Washing shall be performed in accordance with the detergent (powder) specified in section 9.4 of AATCC LP1-2021; parameters for water level, agitator speed, stroke length, washing time, spin speed, spin time, and wash temperature specified in Table I, "Standard Washing Machine Parameters," "(1) Normal" and "(IV) Hot" of AATCC LP1-2021; and a maximum wash load as specified in section 9.2 of AATCC LP1-2021, which may consist of any combination of test samples and dummy pieces. Drying shall be

performed in accordance with section 12.2(A) of AATCC LP1-2021, Tumble Dry, using the exhaust temperature and cool down time specified in Table VI, "Standard Tumble Dryer Parameters," "(Aiii) Permanent Press" of AATCC LP1-2021.

(iii) AATCC LP1-2021, "Laboratory Procedure for Home Laundering: Machine Washing," is incorporated by reference. The Director of the Federal Register approves this incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. A read-only copy of the standard is available for viewing on the AATCC website. You may obtain a copy from the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, North Carolina 27709; telephone (919) 549-8141; www.aatcc.org. You may inspect a copy at the Division of the Secretariat, U.S. Consumer Product Safety Commission, Room 820, 4330 East West Highway, Bethesda, MD 20814, telephone (301) 504-7479, e-mail cpsc-os@cpsc.gov, or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, e-mail fr.inspection@nara.gov, or go to: www.archives.gov/federal-register/cfr/ibr-locations.html.

* * * * *

6. Amend § 1610.7 by revising paragraphs (b) to read as follows:

§ 1610.7 Test sequence and classification criteria.

* * * * *

(b) *Test sequence and classification criteria*. (1) Step 1, Plain Surface Textile Fabrics in the original state.

(i) Conduct preliminary tests in accordance with § 1610.6(a)(2)(i) to determine the fastest burning direction of the fabric.

(ii) Prepare and test five specimens from the fastest burning direction. The burn times determine whether to assign the preliminary classification and proceed to § 1610.6(b) or to test five additional specimens.

(iii) Assign the preliminary classification of Class 1, Normal Flammability and proceed to § 1610.6(b) when:

(A) There are no burn times; or

(B) There is only one burn time, and it is equal to or greater than 3.5 seconds; or

(C) The average burn time of two or more specimens is equal to or greater than 3.5 seconds.

(iv) Test five additional specimens when there is either only one burn time, and it is less than 3.5 seconds; or there is an average burn time of less than 3.5 seconds. Test these five additional specimens from the fastest burning direction as previously determined by the preliminary specimens. The burn times for the 10 specimens determine whether to:

(A) Stop testing and assign the final classification as Class 3, Rapid and Intense Burning only when there are two or more burn times with an average burn time of less than 3.5 seconds; or

(B) Assign the preliminary classification of Class 1, Normal Flammability and proceed to § 1610.6(b) when there are two or more burn times with an average burn time of 3.5 seconds or greater.

(v) If there is only one burn time out of the 10 test specimens, the test is inconclusive.The fabric cannot be classified.

(2) Step 2, Plain Surface Textile Fabrics after refurbishing in accordance with § 1610.6(b)(1).

(i) Conduct preliminary tests in accordance with § 1610.6(a)(2)(i) to determine the fastest burning direction of the fabric.

(ii) Prepare and test five specimens from the fastest burning direction. The burn times determine whether to stop testing and assign the preliminary classification or to test five additional specimens.

(iii) Stop testing and assign the preliminary classification of Class 1, Normal Flammability, when:

(A) There are no burn times; or

(B) There is only one burn time, and it is equal to or greater than 3.5 seconds; or

(C) The average burn time of two or more specimens is equal to or greater than 3.5 seconds.

(iv) Test five additional specimens when there is only one burn time, and it is less than 3.5 seconds; or there is an average burn time less than 3.5 seconds. Test five additional specimens from the fastest burning direction as previously determined by the preliminary specimens. The burn times for the 10 specimens determine the preliminary classification when:

(A) There are two or more burn times with an average burn time of 3.5 seconds or greater. The preliminary classification is Class 1, Normal Flammability; or

(B) There are two or more burn times with an average burn time of less than 3.5 seconds. The preliminary and final classification is Class 3, Rapid and Intense Burning; or

(v) If there is only one burn time out of the 10 specimens, the test results are inconclusive. The fabric cannot be classified.

(3) Step 1, Raised Surface Textile Fabric in the original state.

(i) Determine the area to be most flammable per § 1610.6(a)(3)(i).

(ii) Prepare and test five specimens from the most flammable area. The burn times and visual observations determine whether to assign a preliminary classification and proceed to § 1610.6(b) or to test five additional specimens.

(iii) Assign the preliminary classification and proceed to § 1610.6(b) when:

(A) There are no burn times. The preliminary classification is Class 1, Normal Flammability; or

(B) There is only one burn time and it is less than 4.0 seconds without an SFBB test result code, or it is 4.0 seconds or greater with or without am SFBB test result code. The preliminary classification is Class 1, Normal Flammability; or

(C) There are no base burns (SFBB) regardless of the burn time(s). The preliminary classification is Class 1, Normal Flammability; or

(D) There are two or more burn times with an average burn time of 0.0 to 7.0 seconds with a surface flash only. The preliminary classification is Class 1, Normal Flammability; or

(E) There are two or more burn times with an average burn time greater than 7.0 seconds with any number of base burns (SFBB). The preliminary classification is Class 1, Normal Flammability; or

(F) There are two or more burn times with an average burn time of 4.0 through 7.0 seconds (both inclusive) with no more than one base burn (SFBB). The preliminary classification is Class 1, Normal Flammability; or

(G) There are two or more burn times with an average burn time less than 4.0 seconds with no more than one base burn (SFBB). The preliminary classification is Class 1, Normal Flammability; or

(H) There are two or more burn times with an average burn time of 4.0 through 7.0 seconds (both inclusive) with two or more base burns (SFBB). The preliminary classification is Class 2, Intermediate Flammability.

(iv) Test five additional specimens when the tests of the initial five specimens result in either of the following: There is only one burn time and it is less than 4.0 seconds with a base burn (SFBB); or the average of two or more burn times is less than 4.0 seconds with two or more base burns (SFBB). Test these five additional specimens from the most flammable area. The burn times and visual observations for the 10 specimens will determine whether to:

(A) Stop testing and assign the final classification only if the average burn time for the 10 specimens is less than 4.0 seconds with three or more base burns (SFBB). The final classification is Class 3, Rapid and Intense Burning; or

(B) Assign the preliminary classification and continue on to § 1610.6(b) when:

(1) The average burn time is less than 4.0 seconds with no more than two base burns (SFBB). The preliminary classification is Class 1, Normal Flammability; or

(2) The average burn time is 4.0 to 7.0 seconds (both inclusive) with no more than 2 base burns (SFBB). The preliminary classification is Class 1, Normal Flammability, or

(3) The average burn time is greater than 7.0 seconds. The preliminary classification is Class 1, Normal Flammability; or

(4) The average burn time is 4.0 to 7.0 seconds (both inclusive) with three or more base burns (SFBB). The preliminary classification is Class 2, Intermediate Flammability, or

(v) If there is only one burn time out of the 10 specimens, the test is inconclusive. The fabric cannot be classified.

(4) Step 2, Raised Surface Textile Fabric After Refurbishing in accordance with § 1610.6(b).

(i) Determine the area to be most flammable in accordance with \S 1610.6(a)(3)(i).

(ii) Prepare and test five specimens from the most flammable area. Burn times and visual observations determine whether to stop testing and determine the preliminary classification or to test five additional specimens.

(iii) Stop testing and assign the preliminary classification when:

(A) There are no burn times. The preliminary classification is Class 1, Normal Flammability; or

(B) There is only one burn time, and it is less than 4.0 seconds without an SFBB test result code; or it is 4.0 seconds or greater with or without an SFBB test result code. The preliminary classification is Class 1, Normal Flammability; or

(C) There are no base burns (SFBB) regardless of the burn time(s). The preliminary classification is Class 1, Normal Flammability; or

(D) There are two or more burn times with an average burn time of 0.0 to 7.0 seconds with a surface flash only. The preliminary classification is Class 1, Normal Flammability; or

(E) There are two or more burn times with an average burn time greater than 7.0 seconds with any number of base burns (SFBB). The preliminary classification is Class 1, Normal Flammability; or

(F) There are two or more burn times with an average burn time of 4.0 to 7.0 seconds (both inclusive) with no more than one base burn (SFBB). The preliminary classification is Class 1, Normal Flammability; or

(G) There are two or more burn times with an average burn time less than 4.0 seconds with no more than one base burn (SFBB). The preliminary classification is Class 1, Normal Flammability; or

(H) There are two or more burn times with an average burn time of 4.0 to 7.0 seconds(both inclusive) with two or more base burns (SFBB). The preliminary classification is Class 2,Intermediate Flammability.

(iv) Test five additional specimens when the tests of the initial five specimens result in either of the following: There is only one burn time, and it is less than 4.0 seconds with a base burn (SFBB); or the average of two or more burn times is less than 4.0 seconds with two or more base burns (SFBB). (v) If required, test five additional specimens from the most flammable area. The burn times and visual observations for the 10 specimens determine the preliminary classification when:

(A) The average burn time is less than 4.0 seconds with no more than two base burns (SFBB). The preliminary classification is Class 1, Normal Flammability; or

(B) The average burn time is less than 4.0 seconds with three or more base burns (SFBB). The preliminary and final classification is Class 3, Rapid and Intense Burning; or

(C) The average burn time is greater than 7.0 seconds. The preliminary classification is Class 1, Normal Flammability; or

(D) The average burn time is 4.0 to 7.0 seconds (both inclusive), with no more than two base burns (SFBB). The preliminary classification is Class 1, Normal Flammability; or

(E) The average burn time is 4.0 to 7.0 seconds (both inclusive), with three or more base burns (SFBB). The preliminary classification is Class 2, Intermediate Flammability; or(vi) If there is only one burn time out of the 10 specimens, the test is inconclusive. The fabric cannot be classified.

7. Amend § 1610.8 by revising paragraph (b)(2) to read as follows:

§ 1610.8 Reporting results.

* * * * *

(b) * * *

(2) For Raised Surface Textile Fabrics:

SF ntr Surface flash, does not break the stop thread. No time recorded.

____SF only Time in seconds, surface flash only. No damage to the base fabric.

. SFBB Time in seconds, surface flash base burn starting at places other than the point of impingement as a result of surface flash.

. SFBB poi Time in seconds, surface flash base burn starting at the point of impingement.

. SFBB poi* Time in seconds, surface flash base burn possibly starting at the point of impingement. The asterisk is accompanied by the following statement: "Unable to make absolute determination as to source of base burns." This statement is added to the result of any specimen if there is a question as to origin of the base burn.

Alberta E. Mills, Secretary, Consumer Product Safety Commission.



Staff Briefing Package

Notice of Proposed Rulemaking (NPR) to Amend the Standard for the Flammability of Clothing Textiles

August 24, 2022

For additional information, contact:

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Executive Summary

As part of its authority under the Flammable Fabrics Act (FFA), the U.S. Consumer Product Safety Commission (CPSC) codified the Standard for the Flammability of Clothing Textiles at 16 CFR part 1610. All textile fabrics and related material in a form or ready for use in an article of wearing apparel are required to meet the Standard (16 CFR § 1610.1(e)). The Standard provides a method of testing the flammability of clothing textiles, establishes three classes of flammability, and specifies whether each class can be used for clothing. The Standard also exempts certain fibers from flammability testing, based on a history of consistently acceptable test results.

Staff recommends several updates to the Standard to improve clarity and update outdated equipment and materials. The Commission sought comments on these updates in a Request for Information (RFI) published in 2019.¹ After reviewing those comments, staff submitted a status update briefing package to the Commission in 2020, recommending that the Commission initiate rulemaking to amend the Standard.² In this briefing package, staff provides additional information and test results in support of the recommended changes to the Standard and recommends issuing a notice of proposed rulemaking (NPR) to initiate rulemaking.

Staff's first recommendation is to amend the language in the Standard regarding the description of test result codes (*i.e.*, burn codes). Test result codes reflect information obtained during flammability testing to help determine the classification of a fabric and whether it may be used for clothing. Staff recommends revising these provisions to clarify and streamline the codes.

The second recommended update is to the specification of the stop thread in the Standard. The stop thread is used to determine burn times during flammability testing, which helps determine the classification of the fabric, and whether it may be used for clothing. Staff recommends revising the stop thread description because current descriptions of threads on the market make it difficult to identify threads that comply with the current description in the Standard.

The third recommendation is to amend the equipment requirements in the refurbishing procedures in the Standard. The Standard requires that fabrics be refurbished as part of flammability testing, which includes both dry cleaning and laundering (*i.e.*, washing and drying). Currently, the Standard requires the use of a dry cleaning solvent, perchloroethylene, which has been increasingly restricted, and its use is being banned in some places. Accordingly, staff recommends adding an alternative solvent, which is widely used and available on the market, and appropriate accompanying parameters. Staff recommends updating the equipment specified in the laundering procedures in the Standard as well. Currently, the laundering

Testing.pdf.

¹ 84 Fed. Reg. 16797 (Apr. 23, 2019).

² Status update briefing package available at: <u>https://www.cpsc.gov/s3fs-public/StatusUpdate-</u> <u>16CFRPart1610RuleUpdateandConsiderationforAddingSpandexFiberstotheListofCurrentlyExemptedFibers-from-</u>

procedure requires that washing and drying be performed in accordance with equipment provisions in AATCC Test Method 124-2006. However, washing machines meeting that specification are no longer made. As such, staff recommends revising this requirement to specify that laundering is to occur in compliance with provisions in a more-recent standard, AATCC Laboratory Procedure 1—Home Laundering: Machine Washing (LP 1, 2021), for which machines are readily available on the market. Testing laboratories that still have machines that comply with the current Standard could continue to use those machines under the procedure in 16 CFR § 1610.40, which allows for the use of an alternate apparatus with certain provisions.

The rule is needed to protect the public against unreasonable risk of the occurrence of fire leading to death or personal injury. These recommended revisions would make the mandatory Standard easier to understand and it would reflect currently available materials and equipment. Greater clarity and availability would allow testing laboratories to obtain compliant test materials and equipment and ensure consistent and reliable test results, which maintains the consumer safety this rule provides.

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Briefing Memorandum

TO:	The Commission Alberta E. Mills, Secretary
THROUGH:	Austin C. Schlick, General Counsel Jason K. Levine, Executive Director DeWane Ray, Deputy Executive Director for Operations
FROM:	Duane Boniface, Assistant Executive Director, Office of Hazard Identification and Reduction
	Paige Witzen, Project Manager, Division of Engineering Directorate for Laboratory Sciences
SUBJECT:	Staff Recommendation for a Notice of Proposed Rulemaking (NPR) to Amend the Standard for the Flammability of Clothing Textiles

Introduction

On April 23, 2019, the Commission issued a Request for Information (RFI)¹ about reducing burdens associated with the Standard for the Flammability of Clothing Textiles in 16 CFR part 1610 (the Standard) (84 FR 16797). The Standard, originally issued in 1953, has descriptions and procedures that have become outdated and unclear. The RFI sought comments on aspects of the Standard that the industry may be having difficulty meeting, due to the outdated and unclear materials, equipment, and provisions in the Standard. Staff responded to the comments received from the RFI and, in a Status Update Briefing package submitted to the Commission on September 30, 2020, recommended pursuing testing for equipment and procedural changes.^{2,3} Based on those comments, staff's assessments, and staff's testing, this package provides staff's recommendations for Commission decision on the following updates:

- clarifying the test result code (*i.e.*, burn code) descriptions that are used for reporting test results,
- updating the description of the specified stop thread, and
- updating the refurbishing procedures, including laundering specifications, and dry-cleaning procedures.

² <u>https://www.cpsc.gov/s3fs-public/StatusUpdate-</u>

¹ https://www.govinfo.gov/content/pkg/FR-2019-04-23/pdf/2019-08140.pdf

<u>16CFRPart1610RuleUpdateandConsiderationforAddingSpandexFiberstotheListofCurrentlyExemptedFibers-from-</u> <u>Testing.pdf</u>

³ Staff also addressed comments on adding spandex to the list of exempted fibers. Staff determined that there was not sufficient data to support the addition but would look at it again in the future if additional data are provided.

The recommended updates or changes do not alter the test method or criteria in the Standard for determining the flammability of a fabric or whether it is permissible for use in clothing. CPSC staff is recommending changes only to material and equipment specifications that will clarify and update existing requirements.

Background

In 1953, Congress enacted the Flammable Fabrics Act (FFA; 15 U.S.C. §§ 1191-1204) of 1953 (Pub. L. No. 83-88, 67 Stat. 111). The FFA prohibits importing, manufacturing for sale, or sale in commerce of any article of wearing apparel that is considered dangerously flammable. The FFA of 1953 required that a test, first published by the Department of Commerce as a voluntary commercial standard, then called "Flammability of Clothing Textiles, Commercial Standard 191-53" (CS 191-53), is to be used to determine if fabric or clothing is "so highly flammable as to be dangerous when worn by individuals."⁴ In 1975, the Commission codified⁵ CS 191-53 as the Standard for the Flammability of Clothing Textiles at 16 CFR part 1610.⁶

Since 1975, the Commission has amended 16 CFR part 1610 several times to clarify requirements and update outdated materials, equipment, and technologies. Most recently, the Commission issued a final rule in 2008,⁷ amending the Standard. The final rule reorganized and revised the Standard to improve clarity and reflect available materials and equipment, and it revised test result codes to improve accuracy and consistency.

Risk of Injury

From 2016 through 2020 (the most recent year for which data are available), there were an average of 81 deaths per year in the United States caused by the ignition or melting of clothing. In addition, using CPSC's National Electronic Injury Surveillance System (NEISS),⁸ in the most recent 5 years of NEISS data available (2017–2021), there was an estimated annual average of 5,300 nonfatal injuries associated with clothing ignition treated in U.S. hospital emergency departments. The Standard is intended to reduce the risk of injury and death, by requiring testing and classification criteria to prohibit the use of dangerously flammable clothing textiles. Without the Standard, the reported numbers would almost certainly be higher. Detailed incident information is available in Tab A of this briefing package.

⁴Flammable Fabrics Act of 1953, Pub. L. No. 83-88, 67 Stat. 111.

⁵ In 1967, Congress amended the FFA to allow for rulemaking to issue flammability standards. Pub. L. No. 90–189, 67 Stat. 112 (Dec. 14, 1967). Congress transferred the authority to administer the FFA, including issuing regulations to CPSC in 1972. 15 U.S.C. § 2079(b).

⁶ 40 FR 59884 (Dec. 30, 1975).

⁷73 Fed. Reg. 15636 (Mar. 25, 2008), available at: <u>www.cpsc.gov/s3fs-public/pdfs/blk_pdf_textflamm.pdf</u>.

⁸ NEISS uses a probability sample of about 100 hospitals in the United States that represent all U.S. hospitals with emergency departments to identify and generate national estimates of nonfatal injuries treated in emergency departments.

The Standard

As stated in section 1610.1, "The purpose of the Standard is to reduce danger of injury and loss of life by providing, on a national basis, standard methods of testing and rating the flammability of textiles and textile products for clothing use, thereby prohibiting the use of any dangerously flammable clothing textiles." The Standard: specifies test methods, test apparatus, and materials required for testing the flammability of clothing textiles; establishes three classes of flammability; and specifies whether each class can be used for clothing. As a general overview, the Standard includes specifications for a flammability test apparatus, which consists of a chamber that contains an ignition mechanism, sample rack, and timing mechanism. The test procedure generally involves placing a specimen of fabric in the test apparatus, stringing the stop thread across the top of the specimen, activating a trigger device that impinges a small flame for 1 second, and recording the time it takes to sever the stop thread and observations of the burn behavior of the specimen. This test is performed before and after refurbishing the specimen, which involves specified methods of dry cleaning and laundering, and it must be performed on multiple specimens. After conducting testing, the Standard provides test result codes (*i.e.*, burn codes) to use for recording flammability results for each specimen.

Burn time (*i.e.*, the time elapsed from ignition until the stop thread is severed) and other burning characteristics determine within which of the three classes the fabric falls. Fabrics that fall in Class 1—Normal Flammability, are acceptable for use in clothing. Fabrics that fall in Class 2 — Intermediate Flammability (which applies only to raised surface textile fabrics), can also be used for clothing. Fabrics that fall in Class 3 — Rapid and Intense Burning, are considered dangerously flammable and are prohibited from being used for clothing.

The criteria for each classification differ for plain surface textile fabrics and raised surface textile fabrics. Plain surface textile fabrics are those that do not have an intentionally raised fiber or yarn surface, whereas raised surface textile fabrics have an intentionally raised fiber or yarn surface (see definitions in section 1610.2). Some examples of raised surface fabrics would be velvet or terry cloth.

- Burn time is the main consideration for classifying plain surface fabrics, with a burn time of 3.5 seconds or more being Class 1, and a burn time of less than 3.5 seconds being Class 3.
- Both burn time and burn behavior are relevant to classification for raised surface fabrics. A rapid surface flash that quickly breaks the stop thread but does not burn through the base⁹ of the fabric, is not considered dangerously flammable; it is the combination of burning rapidly and through the base that results in a dangerously flammable fabric.

⁹ The base of a raised surface textile fabric refers to the base that forms the fabric's structure, as opposed to the surface fibers or yarns that are intentionally raised from the base.

- A raised surface fabric is Class 1 if its burn time is greater than 7.0 seconds, or if it exhibits a rapid surface flash (0.0 to 7.0 seconds) and the intensity of the flame is so low as not to ignite or fuse the base fabric.
- A raised surface fabric is Class 2 if its burn time is between 4.0 and 7.0 seconds, inclusive, and the base fabric ignites or fuses.
- A raised surface fabric is Class 3 if the burn time is less than 4.0 seconds, and the base fabric starts burning in places other than the point of impingement as a result of the surface flash.

The Standard identifies the most dangerously flammable items when exposed to a small open flame, while allowing a wide range of textile apparel choices for the consumer.

Discussion

Staff recommends several updates to the Standard on the three items discussed below: test result codes, stop thread, and refurbishing. Staff recommends the test result codes and stop thread descriptions be updated to improve clarity. Staff also recommends updates to the equipment requirements in the refurbishing procedures in the Standard. The Standard requires that fabrics be refurbished as part of flammability testing, which includes both dry cleaning and laundering (*i.e.*, washing and drying).

Clarification of the Test Result Codes

The Standard lists a number of specific test result codes (*i.e.*, burn codes) that describe the burning behavior of fabrics, which must be used to record the flammability results for each specimen and help determine the proper classification for the sample (§ 1610.8). CPSC has received input that some of these codes are confusing, and staff received comments in response to the RFI on the use and needed clarification of the current test result codes. Staff also assessed the various codes for other necessary clarifications and streamlining.

The test result codes differ for plain and raised surface textile fabrics. Staff does not recommend revising the test result codes for plain surface textile fabrics, because, as the comments confirmed, these are clear and straightforward to apply. However, because classifications for raised surface textile fabrics are based on both burn time and burn behavior, test result codes for these fabrics are more complex.

The Standard provides seven test result codes for these fabrics, in addition to one that records just the burn time. The first four codes listed in the standard, SF uc, SF pw, SF poi, and SF only, involve a surface flash only, meaning they involve the surface (*i.e.*, raised) fibers only, whereas the last three codes, SFBB, SFBB poi, and SF poi* apply when the surface fibers and base of the fabric are involved in the burning behavior. These codes are explained in more detail in Tab B of this briefing package.

As presented in more detail in Tab B, staff recommends several revisions to these test result codes. For one, staff recommends revising Table 1 in section 1610.4, which describes classification criteria, to clarify that SFBB (surface fibers and base burn) is the only code used to determine if a fabric is a Class 2 or 3 fabric. Staff also recommends adding a note below the table to clarify that, because SFBBpoi and SFBBpoi* have base burns starting or possibly starting at the point of impingement, they are not considered a base burn for determining Class 2 and 3 fabrics. Staff also recommends adding to the table, the descriptions Normal Flammability, Intermediate Flammability, and Rapid and Intense Burning, because they correspond to each classification, to highlight that Class 2 fabrics are considered more flammable than Class 1 fabrics and that there should be caution when using a Class 2 fabric for clothing. In addition, staff recommends revising section 1610.7, which includes classification criteria, to reference the code SFBB anywhere that "base burn(s)" appears, so it is clear what test result code is being referenced. Also, in section 1610.8, staff recommends replacing the SFpoi, SFpw, and SFuc test result codes with a combined single code, SFntr, for "surface flash, no time recorded," because the three existing codes do not all record a burn time, and all result in Class 1 fabrics.

In addition, staff recommends removing from this section the category that only has a burn time (_._ sec.), which occurs when a base burn and surface flash happen at nearly the same time. Depending on the observation of the tester, SFBB, SFBBpoi, or SFBBpoi* test codes should be used. Having the (_._sec.) category can cause confusion when determining the appropriate classification, and it can result in misclassification.

In addition to revising test result code provisions, staff also recommends revising the definition of "base burn" in section 1610.2(a), to clarify that base burns are used to establish Class 2 and 3 fabrics, and to reference the test result code SFBB. Also consistent with these recommended changes, staff recommends revising the description of Class 2 for raised surface textile fabrics (in section 1610.4(b)(2)) to add the clarification that "base fabric starts burning at places other than the point of impingement as a result of the surface flash (test result code SFBB)."

Staff concludes that the recommended changes address several comments we received, by removing uncertainty in classifying textile fabrics, and creating greater accuracy and consistency with reporting test results. None of these revisions would alter the substantive requirements in the Standard, nor change the classifications resulting from testing; the test result code changes only streamline and clarify the existing requirements.

Stop Thread Description

As discussed, the test apparatus used for flammability testing in part 1610 requires the use of a specified stop thread. The stop thread is used to determine burn time, which is needed to help determine the classification of specimens and whether they are acceptable for use in clothing. The flammability test apparatus must include as stop thread "a spool of No. 50, white, mercerized, 100% cotton sewing thread" (§§ 1610.2(p), 1610.5(a)(2)(ii)). However, thread

meeting this description has limited availability, the numbering cited may be outdated, and the industry now largely uses the "Tex system" to define thread size.¹⁰ As such, staff recommends updating the description of the stop thread in the Standard, by selecting a thread description that yields comparable results to the current Standard, reflects current industry practices, and is readily available.

CPSC staff began a test program in 2021 to evaluate different threads. Staff conducted testing on four different thread types to compare the flammability test results to the thread staff has that meets the current specification. As discussed further in Tab C, staff found that the different threads performed consistently and yielded comparable burn times with the thread currently specified in the Standard. Staff recommends revising the Standard to specify that the stop thread consist of "3-ply, white, mercerized, 100% cotton sewing thread, with a Tex size of 35 to 45 Tex." This retains the primary elements of the current specification but removes the outdated reference to "No. 50" and allows for a range of Tex sizes that are comparable to the current specification. Specifically, staff found that the alternative cotton threads tested had Tex sizes of 37 and 44, while the Tex size of CPSC's current test thread is 36, and the Canadian clothing flammability standard specifies a Tex size of 35. A range of Tex sizes would also provide greater flexibility for testing laboratories to obtain compliant thread, while retaining consistent results. Staff also evaluated alternative polyester threads, which had Tex sizes outside this recommended range; however, staff recommends requiring 100 percent cotton sewing thread with a Tex size of 35 to 45 Tex, for consistency with the current Standard, and because some polyester threads are designed to be flame resistant, which could affect results. Additional information about this testing and recommendation is in Tab C.

Refurbishing Procedures

The Standard requires fabrics to be tested in their original state and after being refurbished (dry cleaned and then laundered) one time. The purpose of the refurbishing requirement is to remove any non-durable or water-soluble treatments present on the fabric that can affect its flammability performance. It is not meant to replicate how the garment is to be used or cared for by the consumer over its useful life.

Dry Cleaning

The Standard requires that fabric samples be dry cleaned in commercial-grade perchloroethylene solvent (§§ 1610.5(b)(7), 1610.6(b)(1)(i)), and it specifies appropriate parameters that accompany this dry cleaning method (*e.g.*, cleaning and drying time). Although perchloroethylene is still widely used in the dry cleaning industry, in recent years, there have been increasing restrictions on its use, and staff is aware of one state's ban that will take effect

¹⁰ Tex is a unit of measurement for linear density defined as grams per 1000 meters of length.

in 2023.¹¹ To balance the ongoing use of perchloroethylene within the industry, with the increasing limitations on its use, staff recommends that the Commission update the Standard to include an additional, alternative dry cleaning solvent that is readily available and yields flammability results comparable to the Standard.

Staff conducted testing to compare dry cleaning with silicone, hydrocarbon, and butylal solvents to the current method using perchloroethylene. The results of our testing show that these procedures produce results that are consistent with the current Standard. Given that perchloroethylene is being phased-out in some states, yet is still widely available and used elsewhere, staff recommends adding another dry cleaning option to the Standard, while allowing the existing perchloroethylene dry cleaning procedure to still be used. Staff recommends selecting the hydrocarbon dry cleaning procedure as an additional alternative, because it is one of the most common alternatives to perchloroethylene, has a long history of use, and is less expensive than other alternatives. Staff also recommends providing appropriate parameters (*e.g.*, cleaning and drying time) to accompany this alternative dry cleaning procedure. Additional details about staff's testing are available in Tab E, and more discussion of the dry cleaning recommendation is available in Tab D.

Laundering

The Standard requires that samples be laundered in washing and drying machines that meet certain conditions in accordance with American Association of Textile Chemists and Colorists (AATCC) Test Method (TM) 124-2006, Appearance of Fabrics After Repeated Home Laundering (§ 1610.6(b)(1)(ii)). However, washing machines that meet this standard are no longer produced; machines have changed substantially over the past 15 years to reduce water use and improve energy efficiency. Specifically, the parameter in the Standard that new machines cannot meet is the minimum agitation speed. As such, staff recommends revising the Standard to require washing procedures that can be met with machines currently on the market and yield flammability results comparable to the current Standard.

Staff conducted testing on two alternate washing machines to compare them to the one in the current Standard. The first alternative was a machine that complies with AATCC Laboratory Procedure 1—Home Laundering: Machine Washing (LP 1, 2021), which states the parameters

https://govt.westlaw.com/calregs/Document/I3065E480D60811DE88AEDDE29ED1DC0A?viewType=FullText&or iginationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default). In addition, the Environmental Protection Agency announced that it is considering steps to address the risks associated with perchloroethylene, including potentially regulating, limiting, or prohibiting production or use of the chemical. See EPA Releases Final Chemical Risk Evaluation for Perchloroethylene (Dec. 14, 2020), available at: <u>EPA Releases</u> Final Chemical Risk Evaluation for Perchloroethylene | US EPA.

¹¹ In 2007, California adopted regulations that take incremental steps to phase out the use of perchloroethylene in the dry cleaning industry over time, and to remove from service all perchloroethylene dry cleaning machines by 2023. See 17 CA ADC § 93109, available at:

that are now used in the current version of TM 124 (2018). The second alternative staff assessed was a procedure that alters the agitation speed of TM 124-2006 to align with reduced agitation speeds now available in machines on the market. The result of our testing shows that these alternative procedures result in flammability results comparable to the current Standard.

Staff recommends that the Commission amend the Standard to replace the existing reference to TM 124-2006 with a reference to LP 1 (2021), Table I (1) Normal (IV) Hot for washing.¹² Staff also recommends replacing the reference to sections 8.2.2 and 8.2.3 in TM 124, with reference to sections 9.2 and 9.4 in LP1, because the latter include equivalent procedures. Section 9.2 specifies a smaller wash load size (1.8 +/- 0.1kg) than the current Standard, which allows for any size load up to the 8 lbs maximum. Staff therefore recommends reducing the maximum load size to be consistent with the load size specified in LP1, for which the washing machines are designed. Staff recommends selecting LP1 rather than the reduced-agitation speed TM124-2006 option because LP1 is a current voluntary standard that some testing laboratories are already using for other testing, while the reduced agitation speed TM124-2006 option would establish a new laundering standard unique to part 1610. Furthermore, there are more washing machines available on the market that meet the specification of LP1 than machines that can meet the reduced agitation speed specifications, because LP1 is an existing standard.

Staff does not recommend retaining TM 124-2006 as an alternative in section 1610.6(b)(1)(ii) of the Standard. The machines that can meet TM 124-2006 are no longer in production. Existing machines that meet TM 124-2006 will be replaced when they reach the end of their useful lives with new machines that are currently available. Provisions in section 1610.40 already would allow firms to continue to use washing machines that comply with the current Standard. Specifically, section 1610.40(d) allows firms to base a guaranty that a fabric or garment complies with the Standard on alternate tests using apparatus or procedures other than those in the Standard, if the alternate is as stringent as, or more stringent than, the Standard. The regulation further states that the Commission considers an alternate test to be as stringent as, or more stringent than, the Standard "if, when testing identical specimens, the alternate test yields failing results as often as, or more often than, the test [in the Standard]." Those using this alternative must have data or information demonstrating this equivalency before using the alternative as the basis for a guaranty and must retain the data or information for 1 year after it is used to support a guaranty, but they need not obtain advance approval from the Commission to use the alternative. Staff recommends that the information in this briefing package and draft NPR, illustrating the equivalency of washing machines that meet TM 124-2006 and LP1, be

¹² Although the current version of TM 124 states the same washing machine parameters as LP 1, staff recommends referencing LP 1 directly, rather than the updated version of TM 124. For one, TM 124 is not just a laundering standard, but it also has procedures for evaluating smoothness in the appearance of fabrics. In addition, recent versions of TM 124 have taken varied approaches—referencing LP 1, referencing another similar standard, and directly stating the parameters—making it more reliably consistent than simply referencing LP 1 directly.
considered acceptable as the data for information required in section 1610.40. The preamble to the draft proposed rule explains this option.

Staff also recommends replacing the reference to TM 124-2006 in the Standard as it applies to drying specifications, with reference to LP1, Table VI, (Aiii) Permanent Press. Staff further recommends replacing the reference to section 8.3.1(A) in TM 124 with reference to section 12.2(A) in LP1 because they include equivalent procedures. The current Standard requires that drying be performed in accordance with TM 124-2006, with an exhaust temperature of 66° ± 5 °C, and following "Durable Press" conditions in that standard. Under LP1, the exhaust temperature is 68 ± 6 °C, and therefore, it is largely equivalent to the current Standard. In addition, where TM 124-2006 references "Durable Press," LP1 refers to "Permanent Press," which is now the more common industry term. Unlike washing machines, clothes dryers that meet the current Standard are still available on the market. However, staff recommends updating this reference to LP1 so that the Standard references a single outside source for laundering specifications, which is simpler for industry members, and it would reflect current industry practices. As with washing machines, provisions in section 1610.40 would allow firms to continue to use clothes dryers that comply with the current Standard. Staff recommends that the information in this briefing package and draft NPR, illustrating the equivalency of laundering methods in TM 124-2006 and LP1, be considered acceptable as the data for information required in section 1610.40.

Additional information about this testing and recommendation is in Tabs D and E.

Relevant Voluntary and Other Standards

Staff has reviewed the following voluntary and international standards that are relevant to 16 CFR part 1610 and the recommended changes:

- ASTM D1230-22, Standard Test Method for Flammability of Apparel Textiles;
- Canadian General Standards Board Standard CAN/CGSB-4.2 No. 27.5, *Textile Test Method Flame Resistance - 45° Angle Test – One-Second Flame Impingement*;
- AATCC TM 124, Appearance of Fabrics After Repeated Home Laundering; and
- AATCC Laboratory Procedure 1 Home Laundering: Machine Washing (LP1).

ASTM D1230 and CAN/CGSB-4.2 No. 27.5 were both created based on the test method in the Standard, although ASTM D1230 contains differences in laundering specifications, terminology, and test result codes. Neither of these standards contains provisions sufficient to address all of the updates that staff recommends. For example, neither of these standards address the issue with stop thread. ASTM D1230 includes a similar stop thread description as the Standard's, and therefore, does not add clarity. The Canadian standard specifies a single permissible Tex value, rather than a range.

As explained, AATCC TM 124-2006 is currently incorporated by reference into the Standard, as part of the laundering requirements. However, washing machines that meet this specification

are no longer available on the market. The current version of AATCC TM 124, from 2018, includes washing and drying specifications that are the same as LP1. Because AATCC TM 124 is not just a laundering standard, but also has procedures for evaluating the smoothness appearance of fabrics, which are not relevant to part 1610, staff recommends directly referencing LP1 for the laundering specifications, instead of referencing AATCC TM 124-2018. In addition, previous versions of AATCC TM 124 have referenced various materials, making it more reliable to directly reference LP1.

As discussed, LP1, which was first published in 2018, and later revised in 2021, includes procedures and washing machine and dryer specifications. Tables IIA through IVB include historical specifications that were previously required for washing machines. One of these historical specifications—Table IIA – Alternate Laundering Parameters (Traditional Top-loading Machines 2000-2008)—includes parameters identical to the current part 1610 Standard laundering procedure (*i.e.*, in AATCC TM 124-2006) under options Normal, Hot. Table I -Standard Washing Machine Parameters, in LP1-2021, provides current specifications for washing machines. For clothes dryers, LP1-2021 specifies a maximum dryer exhaust temperature of 68 ± 6 °C and a cool down time of ≤ 10 minutes for Permanent Press, which is similar, but not identical to, the clothes dryer requirements currently in part 1610. As explained, staff recommends incorporating by reference LP1-2021 for the washing and drying provisions in the Standard.

Regulatory Flexibility Act Analysis and Preliminary Regulatory Analysis

Tab F of this briefing package provides the information required under the Regulatory Flexibility Act to certify that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities, along with the factual basis for this conclusion. Tab F also includes a preliminary regulatory analysis, required by the FFA, which primarily focuses on the potential benefits and costs associated with the rule, and alternatives staff considered.

According to small business size standards set by the Small Business Association (SBA), firms in NAICS sector 541380 (Testing Laboratories) would be considered small if the average annual receipts of a firm are less than \$16.5 million per year.¹³ According to this definition, roughly 70 percent of the CPSC-accepted testing laboratories located in the United States that test to the Standard would be considered small. According to 2020 data available from the Census Bureau, there are 7,389 testing laboratories in the United States.¹⁴ If each of these labs tested to the Standard and approximately 70 percent of testing labs are considered small, then roughly 5,172 small testing labs could potentially be impacted. However, this approximation likely overestimates the number of small firms affected, because not all testing labs in the United States test to the flammability standard.

- ¹³ https://www.sba.gov/document/support-table-size-standards.
- ¹⁴ U.S. Census Bureau, County Business Patterns: Table ID CB2000CBP

Staff expects that there would be some unquantifiable benefits associated with the recommended amendments. Although staff's testing indicates that the recommended amendments would provide flammability test results consistent with the current Standard, the recommended amendments would improve compliance by providing clearer and more up-todate provisions, which is likely to result in more reliable and consistent flammability classifications and reduce burdens associated with sourcing unclear or unavailable materials and equipment for testing laboratories.

Staff expects the recommended amendments would be largely cost-neutral. The recommended revisions to test result codes would not impose costs, because they merely clarify, and do not alter, the Standard. Similarly, the recommended revisions to the stop thread description would not impose costs, because they would allow the continued use of the thread currently specified in the Standard, as well as allow a broader range of thread options, making it easier and less costly for firms to source compliant thread. The recommended update to the dry cleaning provisions would not impose costs because it would retain the current provisions and add an alternative that is low in cost, readily available, and widely used. Finally, although staff notes that the recommended revisions to the laundering requirements could potentially create costs for firms that replace machines that comply with the current Standard with LP1-compliant machines, this cost would likely be low, mitigated by the reduction in burdens for firms unable to source currently required machines, and could be avoided by using the provisions in section 1610.40 to continue to use older machines.

Staff's analysis also discusses potential alternatives to the recommended amendments, notes potential benefits and costs associated with these options, and explains why staff does not recommend these alternatives. Overall, the costs associated with staff's recommended amendments are expected to be very low or non-existent, and other alternatives generally do not offer improved benefits.

Staff's Conclusion and Recommendation

Staff recommends updating specifications in 16 CFR part 1610 to improve clarity and reflect current industry practices and technologies. Specifically, staff recommends changes to test result codes, stop thread specifications and refurbishing (dry cleaning and laundering) procedures as follows:

- Updating the test results codes (*i.e.*, burn codes) to streamline and clarify these reporting provisions,
- Updating the stop thread specifications for clarification, and to allow the use of currently available products that maintains an equivalent level of safety,
- Updating the refurbishing specifications. The recommendations will allow for an alternative dry cleaning solvent and change the washing and drying specifications to align with current industry practices while maintaining an equivalent level of safety.

Staff's recommended changes would not alter the substantive requirements in the flammability testing and performance reporting. The findings in this Briefing Package and supporting memos show that the revisions would not alter the classifications of fabrics determined under the Standard and provide substantial support for these Staff recommendations.

Certification and Notice of Requirements

Because the Standard applies to clothing and textiles intended to be used for clothing, it applies to both non-children's products and children's products. Accordingly, the testing and certification requirements in section 14(a) of the Consumer Product Safety Act (CPSA; 15 U.S.C. 2051-2089) apply to products tested under the Standard. Consistent with the CPSA requirements for testing and certifying children's products, the Commission previously published a notice of requirements (NOR) for third party conformity assessment bodies to obtain accreditation to assess conformity with the Standard. 16 CFR § 1112.15(b)(20).

Staff does not recommend revising provisions regarding the NOR because theamendments recommended above by staff would not require additional equipment or test protocols beyond those that exist in the Standard. As discussed above, the recommended amendments to burn codes merely clarify existing requirements, and the recommended amendments regarding stop thread and dry cleaning continue to allow the use of materials that comply with the current Standard. Although the recommended amendments to laundering specifications differ from the current Standard, 16 CFR § 1610.40 allows continued use of laundering specifications under the current Standard. Therefore, testing laboratories that have demonstrated competence for testing in accordance with the Standard would have the competence to test in accordance with the revised Standard. If the Commission issues a final rule, staff recommends that the Commission accept current accreditations for testing to the Standard and deem them sufficient for testing to the revised Standard. CPSC-accepted third party conformity assessment bodies would be expected, in the normal course of renewing accreditations, to update the scope of their accreditations to reflect the revised standard.

Staff recommends seeking comments on this assessment and implications of the draft proposed rule on testing and certifications.

Effective Date

The FFA states that an amendment to a flammability standard must take effect 12 months after the amendment is issued unless the Commission finds a good cause reason that is in the public interest to implement an earlier or later effective date and publishes the reasons for that finding. The FFA also requires that an amendment of a flammability standard exempt fabrics, related materials, and products "in inventory or with the trade" on the date the amendment becomes effective, unless the Commission prescribes, limits, or withdraws that exemption because it finds that the product is "so highly flammable as to be dangerous when used by consumers for the purpose for which it is intended." 15 U.S.C. § 1193(b).

Staff recommends that the Commission propose a 6-month effective date for this rule. Staff believes there is a good cause basis to conclude that this shorter effective date is in the public interest because the recommended amendments are intended to improve the clarity of the Standard and update materials and equipment to facilitate improved consistency of flammability test results, which should improve consumer safety. Moreover, a shorter effective date may be justified given the anticipated prohibition on the use of perchloroethylene in dry cleaning in California, which takes effect in 2023; that washing machines that meet the Standard are no longer made and the update would make it easier for testing laboratories to get compliant washing machines; and all of the recommended changes should have minimal impacts and are intended for clarity and to relieve burdens associated outdated equipment. However, staff recommends seeking comments on the effective date, particularly whether a shorter or longer date is appropriate, and information supporting why changing the effective is necessary. Commenters may provide information indicating that time would be needed to update equipment and materials, consistent with the NPR. Therefore, staff recommends proposing a 6-month effective date, but seeking comments on the possibility of an alternative effective date.

In addition, staff recommends that the Commission exempt from the recommended amendments those fabrics, related materials, and products "in inventory or with the trade" on the date the amendment becomes effective. Because the draft proposed rule is intended to have minimal impacts, staff did not identify a reason that the rule would justify limiting that exemption, as required in the statute.

Request for Comments

Staff recommends seeking comments on all aspects of the draft proposed rule. However, comments on the following would be particularly helpful:

Test Result Codes:

- The recommended revisions to the test result code provisions and whether additional revisions are necessary, and why;
- Whether other portions of the test result code provisions, not addressed in staff's recommendations, are also unclear.

Stop Thread:

- The recommended revisions to the stop thread specification and whether additional revisions are necessary, and why;
- Views (and data to support them) regarding the equivalency of the recommended description to the existing Standard;
- Whether an alternate range of Tex sizes should be specified, and if so, the appropriate size(s) and justifications (including data) for them.

Dry Cleaning Procedures:

• The recommended revisions to the dry cleaning procedures;

- Views (and data to support them) regarding the equivalency of the alternative hydrocarbon procedure to the existing Standard;
- Whether perchloroethylene should be retained as an option in the Standard;
- Whether hydrocarbon solvent should be the alternative provided, or whether other options should be provided, instead of, or in addition to, hydrocarbon, and if so, the justification (including data) for doing so.

Washing Machine Procedures:

- The recommended revisions to the washing machine specification;
- Views (and data to support them) regarding the equivalency of the LP1 (2021) Table I

 (1) Normal (IV) Hot specification to the existing Standard;
- Whether AATCC TM 124-2006 should be retained as an option in the Standard, and if so, for how long, and the justification for doing so;
- Whether LP1 (2021) Table I (1) Normal (IV) Hot should be the replacement washing machine specification, or whether other options should be provided, instead of, or in addition to, LP1, and if so, the justification (including data) for doing so.

Dryer Procedures:

- The recommended revisions to the dryer specification;
- Views (and data to support them) regarding the equivalency of the LP1 (2021) Table VI (Aiii) Permanent Press specification to the existing Standard;
- Whether AATCC TM 124-2006 should be retained as an option in the Standard, and if so, for how long, and the justification for doing so;
- Whether LP1 (2021) Table VI (Aiii) Permanent Press should be the replacement dryer specification, or whether other options should be provided instead of or in addition to LP1, and if so, the justification (including data) for doing so.

Effective Date:

- The reasonableness of the proposed effective date, and recommendations and justifications for a different effective date;
- In particular, the reasonableness of the proposed effective date, as applied to the dry cleaning solvent alternative, given anticipated prohibitions on the use of perchloroethylene in certain locations, beginning in 2023;
- The reasonableness of the proposed effective date, as applied to the laundering specifications, including whether laboratories need to update their machines sooner, or extend the time needed to make anticipated updates.
- The reasonableness of the proposed effective date for all of the proposed requirements, and whether a shorter date would be appropriate to provide the clarity and updates sooner.

Economic Analyses:

- The benefit and cost estimates provided in the package, and whether additional or different benefits and costs should be considered;
- The number of firms expected to be impacted by the recommended rule;
- Information and data regarding the benefits and costs associated with the rule;
- The alternatives to the recommended rule and the benefits and costs associated with them; and
- The number of small entities expected to be affected by the rule, and benefits and costs to those firms.

Tab A: Memorandum by the Directorate for Epidemiology, Incident Data

DATE: July 6, 2022

	Division of Engineering, Directorate for Laboratory Sciences
THROUGH:	Steve Hanway, AED Directorate for Epidemiology (EPI)
	Risana Chowdhury, Director, Division of Hazard Analysis, Directorate for Epidemiology (EPHA)
FROM:	David Miller, Statistician Division of Hazard Analysis (EPHA) Directorate for Epidemiology
SUBJECT:	Clothing Ignition Fatalities and Emergency Department- Treated Injuries

Paige Witzen, Project Manager

Background

TO:

CPSC staff is providing information on the recommended notice of proposed rulemaking (NPR) to update certain provisions of the Clothing Flammability Standard (16 CFR part 1610). This staff memorandum provides information about deaths and injuries associated with clothing fires.

Methodology

Clothing Fire Deaths:

The National Center for Health Statistics (NCHS) maintains a database of all recorded deaths in the 50 states and the District of Columbia. It is called the CDC Wonder Online Database (<u>http://wonder.cdc.gov//ucd-icd10.html</u>). The database has a variable called *Underlying Cause of Death*, which uses two different codes (from the list of International Classification of Diseases or ICD codes, version 10) for the ignition of clothing. They are:

- X05 Exposure to ignition or melting of nightwear
- X06 Exposure to ignition or melting of other clothing and apparel.

These two codes were used to identify clothing fire deaths for the years 2011–2020.

CPSC staff produces estimates of clothing fires and associated losses (and fires and losses involving other products) using the National Fire Incident Reporting System (*NFIRS*), which is a database comprising fire department reports. However, not all fire departments report to NFIRS, and counts of NFIRS clothing fires (and clothing fire deaths, injuries, and property loss) represent only a fraction of the total number of such fires, deaths, injuries, and property loss. CPSC staff uses national total estimates from the National Fire Protection Association's (NFPA) Survey of Fire Departments to estimate the proportion of total fires, deaths, injuries, and

property loss respectively that are reported to NFIRS. Staff uses these estimated proportions to help produce their product specific fire and fire loss estimates.

Unlike the NFIRS estimates, the counts of death certificates from CDC Wonder are a census of all death certificates in the nation. Because it is a census of all the death certificates where clothing fire was cited as the underlying cause of death, the CDC Wonder data include some deaths left out of the NFIRS estimates. The NFIRS estimates exclude deaths from fires that were set intentionally and deaths from fires that occurred outside of residential structures. The counts from the CDC Wonder database include deaths from fires that occur outside of residences and from fires that were set intentionally.

Clothing Fire Injuries:

Estimates of nonfatal burn injuries associated with clothing ignition were based on data reported through CPSC's National Electronic Injury Surveillance System (NEISS), a probability sample of about 100 hospitals that represent all hospitals with emergency departments in the United States. Participating hospitals capture all injuries associated with consumer products and recreational activities that are treated in their emergency departments, allowing calculation of national estimates of injuries by product, along with confidence intervals and trends associated with those estimates.

To identify NEISS injuries caused by the ignition of clothing worn by consumers, CPSC staff used the following NEISS product codes:

- 1644 Nightwear
- 1645 Daywear
- 1646 Outerwear
- 1658 Clothing Not Specified
- 1677 Other Clothing

The NEISS code for Diagnosis and the narrative were also used to identify which incidents were in-scope as clothing ignition injuries. The incidents considered in-scope were limited to those with a Diagnosis code of either '51 – Thermal Burns' or '47 – Burns Not Specified.' Also, to be considered in-scope, an incident had to have comments in the narrative indicating clothing ignition.

Results

Clothing Fire Deaths:

The counts of clothing ignition fire deaths (from NCHS) for the years 2011–2020 are presented in Table 1 below. These are the most recent 10 years for which NCHS has these data available. The death counts are broken down into deaths resulting from the ignition or melting of nightwear, and those caused by the ignition or melting of other clothing or apparel. The table

also includes the clothing-ignition fire death rate (per million population). Figure 1 displays the clothing-fire death rate (per million population) that is seen in the last column of Table 1.

Year	Deaths	Nightwear	Other Clothing	Deaths per Million Population
2011	87	4	83	0.28
2012	92	3	89	0.29
2013	80	0	80	0.25
2014	95	2	93	0.30
2015	56	3	53	0.17
2016	68	0	68	0.21
2017	97	6	91	0.30
2018	71	3	68	0.22
2019	73	1	72	0.22
2020	96	1	95	0.29
2016 – 2020 Avg.	81	2.2	78.8	0.25

Table 1. Clothing Ignition Fatalities, 2011–2020

Source: Death counts obtained from CDC Wonder data. Population estimates obtained from U.S. Census resident population estimates (<u>https://www.census.gov/data/datasets/time-series/demo/popest/2010s-national-detail.html</u>).





Source: CDC Wonder (NCHS) death counts and U.S. Census bureau resident population estimates.

The annual average number of deaths over the last 5 available years of data (2016–2020), where the Underlying Cause of Death was the ignition or melting of clothing is 81. These 81

deaths consist of an annual average of 2.2 deaths from the ignition or melting of nightwear and 78.8 deaths from the ignition or melting of other clothing. The annual average fire death rate from clothing ignition for this period (2016–2020) is 0.25 per million people.

Clothing Fire Injuries:

Staff produced NEISS injury estimates for nonfatal, emergency room-treated injuries caused by clothing ignition for the years 2012–2021. These are the most recent 10 years for which NEISS data are complete and can be used to make such estimates. Table 2 displays these estimates, as well as the number of NEISS cases that each estimate is based on: (N), the standard deviation (SD), the coefficient of variation (CV)¹, and the 95 percent confidence intervals for these estimates.

Year	N	Estimate	Injuries per Million	SD	сv	95% Confidence Interval
2012	102	3,400	10.91	582.9	0.17	(2,300, 4,600)
2013	109	3,000	9.55	705.6	0.23	(1,600, 4,400)
2014	146	5,200	16.45	811.2	0.15	(3,600, 6,800)
2015	162	4,500	13.91	919.7	0.21	(2,700, 6,300)
2016	148	5,600	17.43	831.4	0.15	(4,000, 7,300)
2017	131	4,900	15.01	939.3	0.19	(3,000, 6,700)
2018	135	5,600	17.26	757.3	0.13	(4,200, 7,100)
2019	144	5,100	15.52	1,116.3	0.22	(2,900, 7,300)
2020	170	5,300	16.18	1,353.5	0.25	(2,700, 8,000)
2021	184	5,700	17.37	1,099.4	0.19	(3,600, 7,900)
2017 – 2021 Avg.	152.8	5,300	16.27	923.1	0.17	(3,500, 7,100)

Table 2. NEISS Clothing Ignition Injury Estimates, 2012–2021

Source: National Electronic Surveillance System (NEISS) estimates and U.S. Census Bureau resident population estimates.

Figure 2 displays the NEISS clothing ignition injury estimates for the years 2012 – 2021. Figure 3 shows the estimated NEISS clothing ignition injury rate (per million population) for these same years.

Figure 2. NEISS Clothing Ignition Injury Estimates, 2012–2021



Source: National Electronic Injury Surveillance System (NEISS) estimates.





Source: National Electronic Surveillance System (NEISS) estimates and U.S. Census Bureau resident population estimates.

The upward trend in the NEISS clothing ignition injury estimates from 2012–2021 is statistically significant with a p-value of 0.0062. This is due to the estimates in 2012 and 2013 being much

lower than the subsequent estimates. The estimates from 2014 through 2021 do not show a statistically significant upward trend.

The annual average estimate, for the most recent five years (2017–2021), is 5,300 NEISS clothing ignition injuries with a 95 percent confidence interval of (3,500, 7,100). The estimate of an upward trend in the 2017–2021 estimates is not statistically significant (p-value is 0.4824).

Summary

In support of CPSC staff's recommended NPR to update some of the provisions of the Clothing Flammability Standard (16 CFR part 1610), staff has assessed data on the clothing flammability hazard. According to NCHS CDC Wonder data, there have been 81 deaths per year in the United States (in the most recent 5 years available) caused by the ignition or melting of clothing. In addition to the counts of clothing fire fatalities, CSPC staff is able to use NEISS to estimate the number of emergency department-treated injuries caused by clothing ignition. Based on the most recent 5 years of NEISS data available (2017–2021), there was an estimated annual average of 5,300 such injuries, with a 95 percent confidence interval of (3,500, 7,100). The injury estimates show a statistically significant upward trend over the most recent 10 years (2012–2021), but not over the most recent 5 years, or even from 2014–2021.

Tab B: Memorandum of the Directorate ofLaboratory Sciences, Division of Engineering,Test Result Code Clarification

TO:	Paige Witzen, Project Manager Division of Engineering
THROUGH:	Andrew G. Stadnik, Associate Executive Director Directorate for Laboratory Sciences
	Allyson Tenney, Division Director Division of Engineering Directorate for Laboratory Sciences
FROM:	Paige Witzen, Textile Technologist Division of Engineering
SUBJECT:	Clarification of Test Result Code Descriptions in the Standard for the Flammability of Clothing Textiles – 16 CFR part 1610

Introduction

The Standard for the Flammability of Clothing Textiles (the Standard) lists test result codes (*i.e.*, burn codes) that describe the burning behavior of fabrics, which must be used to record the flammability results for each specimen (§ 1610.6(c)(7)) and help determine the proper classification for the sample (§ 1610.8(b)(2)). CPSC requested comments on the test codes and the need for their clarification in a Request for Information (RFI) published in the *Federal Register* on April 23, 2019 (84 Fed. Reg. 16797), which noted that CPSC has received input that the descriptions of some of the codes are unclear, particularly for raised surface fabrics. Staff received two comments from the 2019 RFI in support of clarifying the test result codes. Updating the description of the test result codes would address uncertainty and enhance consistency in reporting results for 16 CFR part 1610, which enhances the accuracy of flammability classifications and consumer safety.

Background

The Standard provides requirements for testing and rating the flammability of textile fabrics for apparel use. As a general overview, the Standard includes specifications for a flammability test apparatus, which consists of a chamber that contains an ignition mechanism, sample rack, and timing mechanism. The test procedure generally involves placing a specimen of fabric in the test apparatus, stringing a stop thread across the top of the specimen, activating a trigger device that impinges a flame, and recording the time it takes to sever the stop thread and make observations of the burn behavior of the specimen. The Standard also establishes three classes of flammability of clothing textiles and prohibits the use of textiles unsuitable for clothing. Class 1 and 2 fabrics are permissible for use in clothing, while class 3 fabrics are not. The flammability classes are determined by the measure of burn time (*i.e.*, time from impingement of the flame to severing of the stop thread) and flame intensity (discussed below). The Standard requires that the burn time be recorded and that the visual observation of the burn behavior be recorded using the test result codes provided in section 1610.8.

The requirements for each class are different for plain and raised surface textile fabrics. Fabrics are determined to be either plain surface or raised surface textile fabrics according to definitions in § 1610.2(k) and (I). The classification of a plain surface textile fabric is determined by average

burn time and is usually straightforward to classify. Plain surface fabrics that have a burn time of 3.5 seconds or more, DNI (did not ignite) or IBE (ignited but extinguished) test result codes are considered Class 1 fabrics and exhibit normal flammability. Plain surface fabrics that have a burn time of less than 3.5 seconds are considered Class 3 fabrics and are considered dangerously flammable due to their rapid and intense burning. There is no Class 2 category for plain surface fabrics.

Determining the burning characteristics of raised surface textile fabrics is more challenging. These fabrics consist of the base of the fabric, which is the fabric's structure, and the surface fibers or yarns that are intentionally raised from the base of the fabric, such as a velvet or terry cloth fabric. These fabrics are classified by fabric burn time and intensity of the surface burning. The test result codes for raised surface fabrics reflect various burn behaviors within two general categories of intensity—surface flashes and base burns. The regulations (1610.8) provide eight test result codes for raised surface fabrics. Four codes—SFuc, SFpw, SFpoi, and SF only indicate a surface flash (SF). Three codes—SFBB, SFBBpoi, and SFBBpoi*—indicate that a surface flash and a base burn occurred (SFBB). All SF codes result in a fabric being designated class 1. However, when a surface flash is intense enough to burn through the base of the fabric (*i.e.*, base burn, SFBB), it may be Class 2 or 3. Thus, the intensity that factors into classifications is the visual observation of a "base burn" (base fabric ignition or fusing).

Raised surface fabrics that have a burn time greater than 7.0 seconds (no matter the test result code used) are considered Class 1 fabrics. Also, raised surface fabrics with a burn time less than or equal to 7.0 seconds, with no base burns, are considered Class 1 fabrics. Raised surface textile fabrics that have a burn time of 4.0 to 7.0 seconds (inclusive) with a base burn are considered a Class 2 fabric and are considered to have intermediate flammability. Raised surface textile fabrics that have a burn time of less than 4 seconds with a base burn are considered a Class 3 fabric. Class 3 fabrics are considered not acceptable for clothing textiles. The classification of fabrics is also shown in Table 1 of section 1610.4, and below.

The Commission added test result codes to the regulations in 2008, intending to provide additional clarification for the reporting of test results for plain and raised surface textile fabrics. For plain surface fabrics, the codes DNI (did not ignite) and IBE (ignited, but extinguished) were added to describe the burning behavior when there is not a burn time to record. For plain surface fabrics with a burn time, no code is needed. Raised surface textile fabrics, because of their construction, have more complex burn behaviors. As stated above, the regulations currently provide eight test result codes for raised surface fabrics. One test result code (_.__ sec.) simply provides the burn time. Four additional test result codes apply if there is a surface flash—SFpoi (surface flash at the point of impingement only), Sfuc (surface flash under the stop thread), SFpw (surface flash part way, meaning it did not reach the stop thread) and SF with a

burn time. As indicated above, raised surface fabrics include the base of the fabric, which is the fabric's structure, and the surface fibers or yarns that are intentionally raised from the base of the fabric.

The burning behavior of raised surface fabrics is called surface flash when it only involves the surface fibers or yarns. A surface flash code is used for determining Class 1 fabrics. There are three additional test result codes to describe when the surface fiber and the base of the fabric are involved in the burning behavior–SFBB (surface flash with a base burn starting somewhere other than the point of impingement), SFBBpoi (surface flash with base burn starting at the point of impingement) and SFBBpoi* (surface flash with base burn where the base burn possibly started at the point of impingement but unable to make an absolute determination on where the base burn started). To classify textile fabrics as Class 2 or 3, only the test result code SFBB is used. SFBB burns are used when the base burn occurs as a result of the surface flash, rather than from the point of impingement of the burner; whereas SFBBpoi and SFBBpoi* only have a base burn, due to the flame that impinges on the fabric, not from the intensity of the surface of the fabric itself burning.

Discussion and Recommendations

CPSC staff recommends changes to section 1610.4 Table 1 to clarify that fabrics that burn with a test result code of SFBB are the only fabrics where burn time is used to determine if a fabric is a Class 2 or 3 fabric. The note below the table also clarifies that because SFBBpoi and SFBBpoi* have base burns starting or possibly starting at the point of impingement, they are not considered a base burn for determining Class 2 and 3 fabrics. The addition of Normal Flammability (Class 1), Intermediate Flammability (Class 2), and Rapid and Intense Burning (Class 3) were added to note that Class 2 fabrics are considered more flammable than Class 1 fabrics, and that there should be caution when using a Class 2 fabric for clothing. Class 3 fabrics are considered dangerously flammable and not acceptable for use for clothing textiles.

Current Regulatory Language:

Table 1 to § 1610.4 – Summary of Test Criteria for Specimen Classification

[See § 1610.7]

Class	Plain Surface Textile Fabric	Raised Surface Textile Fabric
1	Burn time is 3.5 seconds or more	(1) Burn time is greater than 7.0 seconds; or
	ACCEPTABLE (3.5 sec is a pass).	(2) Burn time is 0-7 seconds with no base
		burns (SFBB). Exhibits rapid surface flash
		only.

		ACCEPTABLE
2	Class 2 is not applicable to plain surface textile fabrics.	Burn time is 4-7 seconds (inclusive) with base burn (SFBB). ACCEPTABLE
3	Burn time is less than 3.5 seconds. NOT ACCEPTABLE.	Burn time is less than 4.0 seconds with base burn (SFBB). NOT ACCEPTABLE

Recommended Regulatory Language:

Table 1 to § 1610.4 – Summary of Test Criteria for Specimen Classification

[See § 1610.7]

Class	Plain Surface Textile Fabric	Raised Surface Textile Fabric
1	Burn time is 3.5 seconds or more	(1) Burn time is greater than 7.0 seconds; or
	ACCEPTABLE (3.5 sec <mark>onds</mark> is a	(2) Burn time is less than or equal to 7.0
	pass).	seconds with no SFBB test result code.
		Exhibits rapid surface flash only.
		ACCEPTABLE- Normal Flammability.
2	Class 2 is not applicable to plain	Burn time is 4.0 to 7.0 seconds (inclusive) with
	surface textile fabrics.	base burn (SFBB).
		ACCEPTABLE- Intermediate Flammability.
3	Burn time is less than 3.5 seconds.	Burn time is less than 4.0 seconds with base
	NOT ACCEPTABLE.	burn (SFBB).
		NOT ACCEPTABLE- Rapid and Intense
		Burning

Note: SFBBpoi and SFBBpoi* are not considered a base burn for determining Class 2 and 3 fabrics.

Staff recommends adding to section 1610.7, anywhere the word base burn/s is stated: "(SFBB)" after it. This change will make the language consistent with the other recommended changes and make clear what test result code is being referenced.

Recommended revisions to section 1610.7(b)(3) and (b)(4):

Section 1610.7(b)(3)(iii)(B) There is only one burn time, and it is less than 4.0 seconds without a base burn an SFBB test result code, or it is 4.0 seconds or greater with or without a base burn an SFBB test result code. The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(3)(iii)(C) There are no base burns (SFBB), regardless of the burn time(s). The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(iii)(D) There are two or more burn times with an average burn time of 0.0 to 7.0 seconds with a surface flash only. The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(3)(iii)(E) There are two or more burn times with an average burn time greater than 7.0 seconds with any number of base burns (SFBB). The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(3)(iii)(F) There are two or more burn times with an average burn time of 4.0 through 7.0 seconds (both inclusive) with no more than one base burn (SFBB). The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(3)(iii)(G) There are two or more burn times with an average burn time less than 4.0 seconds with no more than one base burn (SFBB). The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7 (b)(3)(iii)(H) There are two or more burn times with an average burn time of 4.0 through 7.0 seconds (both inclusive) with two or more base burns (SFBB). The preliminary classification is Class 2, Intermediate Flammability.

Section 1610.7(b)(3)(iv) Test five additional specimens when the tests of the initial five specimens result in either of the following: There is only one burn time, and it is less than 4.0 seconds with a base burn (SFBB); or the average of two or more burn times is less than 4.0 seconds with two or more base burns (SFBB). Test these five additional specimens from the most flammable area. The burn times and visual observations for the 10 specimens will determine whether to:

Section 1610.7(b)(3)(iv)(A) Stop testing and assign the final classification only if the average burn time for the 10 specimens is less than 4.0 seconds with three or more base burns (SFBB). The final classification is Class 3, Rapid and Intense Burning; or

Section 1610.7(b)(3)(iv)(B)(1) The average burn time is less than 4.0 seconds with no more than two base burns (SFBB). The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(3)(iv)(B)(2) The average burn time is 4.0 to 7.0 seconds (both inclusive) with no more than 2 base burns (SFBB). The preliminary classification is Class 1, Normal Flammability, or

Section 1610.7(b)(3)(iv)(B)(3) The average burn time is greater than 7.0 seconds. The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(3)(iv)(B)(4) The average burn time is 4.0 through 7.0 seconds (both inclusive) with three or more base burns (SFBB). The preliminary classification is Class 2, Intermediate Flammability, or

Section 1610.7(b)(4)(iii)(B) There is only one burn time, and it is less than 4.0 seconds without a base burn an SFBB test result code; or it is 4.0 seconds or greater with or without a base burn an SFBB test result code. The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(4)(iii)(C) There are no base burns (SFBB), regardless of the burn time(s). The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(4)(iii)(D) There are two or more burn times with an average burn time of 0.0 to 7.0 seconds with a surface flash only. The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(4)(iii)(E) There are two or more burn times with an average burn time greater than 7.0 seconds with any number of base burns (SFBB). The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(4)(iii)(F) There are two or more burn times with an average burn time of 4.0 through 7.0 seconds (both inclusive) with no more than one base burn (SFBB). The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(4)(iii)(G) There are two or more burn times with an average burn time less than 4.0 seconds with no more than one base burn (SFBB). The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(4)(iii)(H) There are two or more burn times with an average burn time of 4.0 through 7.0 seconds (both inclusive) with two or more base burns (SFBB). The preliminary classification is Class 2, Intermediate Flammability.

Section 1610.7(b)(4)(iv) Test five additional specimens when the tests of the initial five specimens result in either of the following: There is only one burn time, and it is less than 4.0

seconds with a base burn (SFBB); or the average of two or more burn times is less than 4.0 seconds with two or more base burns (SFBB).

Section 1610.7(b)(4)(v)(A) The average burn time is less than 4.0 seconds with no more than two base burns (SFBB). The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(4)(v)(B) The average burn time is less than 4.0 seconds with three or more base burns (SFBB). The preliminary and final classification is Class 3, Rapid and Intense Burning; or

Section 1610.7(b)(4)(v)(C) The average burn time is greater than 7.0 seconds. The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(4)(v)(D) The average burn time is 4.0 to 7.0 seconds (both inclusive), with no more than two base burns (SFBB). The preliminary classification is Class 1, Normal Flammability; or

Section 1610.7(b)(4)(v)(E)The average burn time is 4.0 to 7.0 seconds (both inclusive), with three or more base burns (SFBB). The preliminary classification is Class 2, Intermediate Flammability; or

Staff also recommends revising the test result codes for raised surface fabrics in section 1610.8 to streamline the codes, by consolidating similar ones, and removing others for clarity. Currently in section 1610.8, the SFpoi, SFpw, and SFuc test result codes all describe burning behavior that does not have enough intensity to break the stop thread and all result in Class 1 textile fabrics. Staff recommends the codes SFpoi, SFpw, and SFuc all be combined into a single SFntr (no time recorded) code, because they all are codes for which there is no need to record a burn time and all result in Class 1 fabrics. Given the purpose of the test result codes is to determine the classification of fabrics and their permissibility for use in clothing, it is not necessary to provide these three separate test result codes.

In addition, staff recommends removing the category for raised surface fabrics that only indicates burn time (_.__sec.). Burn time, alone, for raised surface fabrics, does not determine the classification of the fabric, because the test result codes and classifications also depend on the burning behavior. For example, a specimen with a designated burn time could have a base burn and surface flash happening at nearly the same time, or the specimen could exhibit burning behavior, where the base of the fabric is ignited by the intense burning surface fibers (SFBB) so quickly that it is considered a Class 3 textile fabric. Because there is no test result code associated with the (_._sec.), it could be misclassified as a Class 1. Because the _._ sec.

category does not provide sufficient information to determine the classification of the fabric, it can be removed, and testers can simply rely on test result codes SFBB, SFBBpoi or SFBBpoi,* depending on the observation of the tester. Removing the _._ sec. category would eliminate an unnecessary entry from the list of test result codes and improve clarity and the accuracy of classifications. The resulting revisions to the Standard would be:

Recommended Language for section 1610.8(b)(2):

(2) For Raised Surface Textile Fabrics:

SF uc Surface flash, under the stop thread, but does not break the stop thread.

SF pw Surface flash, part way. No time shown because the surface flash did not reach the stop thread.

SF poi Surface flash, at the point of impingement only (equivalent to "did not ignite" for plain surfaces).

SF ntr Surface flash, does not break the stop thread. No time recorded.

_.__ sec. Actual burn time measured by the timing device in 0.0 seconds.

. SF only Time in seconds, surface flash only. No damage to the base fabric.

. SFBB Time in seconds, surface flash base burn starting at places other than the point of impingement as a result of surface flash.

. SFBB poi Time in seconds, surface flash base burn starting at the point of impingement.

. SFBB poi* Time in seconds, surface flash base burn possibly starting at the point of impingement. The asterisk is accompanied by the following statement: "Unable to make absolute determination as to source of base burns." This statement is added to the result of any specimen if there is a question as to origin of the base burn.

In addition, staff recommends revising the definition of "base burn" in section 1610.2(a), to clarify that base burns are used to establish Class 2 and 3 fabrics, and to reference the test result code SFBB for clarity. The recommended change is as follows:

Base burn (also known as base fabric ignition or fusing) means the point at which the flame burns the ground (base) fabric of a raised surface textile fabric and provides a self-sustaining flame. Base burns, used to establish a Class 2 or 3 fabric, are burns resulting from surface flash that occur on specimens, in places other than the point of impingement (test result code SFBB), when the warp and fill yarns of a raised surface

textile fabric undergo combustion. Base burns can be identified by an opacity change, scorching on the reverse side of the fabric, or when a physical hole is evident. Also consistent with these recommended changes, staff recommends revising the description of Class 2 for raised surface textile fabrics in section 1610.4(b)(2) to add the clarification that "base fabric starts burning at places other than the point of impingement as a result of the surface flash (test result code SFBB)."

Conclusion

The recommended changes would consolidate the test result codes, ensure the language is consistent throughout the regulation, and provide better clarity in classifying textile fabrics, which allows for more accuracy and consistency with reporting test results and flammability classifications. Improving the accuracy and consistency of classifications provides greater consumer safety. Because the recommended changes do not alter the classifications that result from these test result codes, it would not change the classifications of fabrics tested under the Standard, other than to improve the accuracy and consistency of results.

Tab C: Memorandum of the Directorate ofLaboratory Sciences, Division of Engineering,Stop Thread Specification

- TO: Paige Witzen, Textile Technologist 1610 Burden Reduction Project Manager Division of Engineering Directorate for Laboratory Sciences
- **THROUGH:** Andrew G. Stadnik, Associate Executive Director Directorate for Laboratory Sciences

Allyson Tenney, Director Division of Engineering Directorate for Laboratory Sciences

FROM: Emily Maling, Textile Technologist Division of Engineering Directorate for Laboratory Sciences

> Weiying Tao, Textile Technologist Division of Engineering Directorate for Laboratory Sciences

SUBJECT: Specification of Threads used to Conduct Tests for Standard for the Flammability of Clothing Textiles -16 CFR Part 1610

Introduction

The Standard for the Flammability of Clothing Textiles – codified at 16 CFR part 1610 (Standard) – provides testing procedures and requirements for the flammability of textiles and clothing made of those textiles. The Standard specifies test methods, test apparatus and materials required for testing. The test generally involves placing a textile specimen in the test apparatus, stringing stop thread across the specimen, activating a trigger device that impinges a flame, and recording the time it takes to sever the stop thread, and observations of the burn behavior of the specimen. The burn time—the time elapsed from ignition until the stop thread is severed—is one measure used to determine the classification of the textile and whether it may be used for clothing.

One component of the Standard specifies the stop thread that must be used in the test apparatus. Section 1610.5(a)(2)(ii) states that the stop thread supply, "consisting of a spool of No. 50, white, mercerized, 100% cotton sewing thread, shall be fastened to the side of the chamber and can be withdrawn by releasing the thumbscrew holding it in position." Likewise, section 1610.2(p) defines "stop thread supply" as "No. 50, white, mercerized, 100% cotton sewing thread." However, there is no further explanation or specific definition in the Standard for "No. 50" thread. The No. 50 thread that CPSC historically has used is no longer available on the market, and it is unclear if other threads sold as No. 50 to meet the Standard are equivalent. A

DATE: May 23, 2022

clear specification of the stop thread is necessary to ensure that testing laboratories can purchase the correct thread to obtain consistent testing results.

To develop a better description of the stop thread, CPSC staff characterized the historical thread supply currently used at CPSC that meets the Standard, and they compared it with another thread on the market sold as meeting the Standard. A thread comparison testing study was also developed to determine if differences in the thread, such as fiber type and size (linear density), have a significant effect on the burn times, and thus, the flammability results of fabrics tested. This memorandum summarizes the results of this thread comparison study and recommends an alternative thread description, based on these results.

Background and Previous Work

Currently, most countries are using the Tex system to define thread size. "Tex" is defined as the weight in grams of 1000 meters of yarn. If a stop thread with a Tex size and cotton fiber content is specified in the Standard, testing laboratories around the world can purchase the specified equivalent cotton thread to conduct the testing for repeatable and reliable results. Previous work by CPSC staff described and characterized the Tex size of thread used at CPSC (Thread A), as well as another thread sold on the market, as meeting the Standard (Thread B).¹ These threads are described and pictured below.

A. Specified Test Thread - Size 50, white mercerized 100% cotton sewing thread (Thread A)

CPSC staff maintains a supply of this thread and uses this cotton thread for testing. This is a 3ply thread. Staff has determined that this cotton thread is the correct stop thread that should be used for testing, as specified in the Standard. However, this specific thread is no longer available on the market. CPSC Staff determined this thread has a Tex size of 36.¹

¹Status Update: 16 CFR Part 1610 Rule Update and Consideration for Adding Spandex Fibers to the List of Currently Exempted Fibers from Testing, Tab B: Directorate for Laboratory Sciences Memo on Stop Thread. September 30, 2020. <u>https://www.cpsc.gov/s3fs-public/StatusUpdate-16</u>

CFRPart 1610 Rule Update and Consideration for Adding Spandex Fibers to the List of Currently Exempted Fibers - from Testing.pdf



Thread A

B. Commercially available thread (Thread B)

Thread B is labeled: Item Code 1502002, CFR1610, #50 mercerized cotton thread, lot 12308. This is also a 3-ply thread. This thread is not used in testing in the CPSC laboratory, but CPSC staff believes that it is used by commercial laboratories and manufacturers when testing to the Standard. It is sold by the vendor as an appropriate thread for testing to the Standard, and it is available on the market. CPSC Staff determined this thread has a Tex size of 44.¹



Thread B

Description of Thread in Other Standards

Both Canada and ASTM have standards similar to 16 CFR part 1610, and each describes the stop thread. ASTM D1230-17 Standard Test Method for Flammability of Apparel Textiles Section 6.11 describes the thread as "Cotton Sewing Thread, No. 50, mercerized." This definition is similar to the definition in 16 CFR § 1610.5(a)(2)(ii) and does not provide any additional description of what is meant by "No. 50," leaving it unclear. The Canadian General Standards Board Standard CAN/CGSB-4.2 No. 27.5, titled, Textile Test Method Flame Resistance - 45° Angle Test – One-Second Flame Impingement, is a standard similar to 16 CFR part 1610. This Canadian standard specifies sewing thread R 35 Tex/3 (No. 50, 3-ply) mercerized cotton as the stop thread for testing. This thread is essentially the same thread that CPSC staff currently uses for testing, as determined by Tex measurements. The additional description of the Tex size and the ply make the description in the Canadian Standard clearer than ASTM D1230-17 and 16 CFR part 1610. Adding a similar Tex and ply description to 16 CFR part 1610 was identified as a potential solution to eliminate the uncertainty in the specified thread.

Comparison Study Methods and Materials

CPSC staff conducted comparison testing to examine the effect of using different threads on the burn time results of flammability testing according to 16 CFR part 1610. Staff examined five different threads with two different plain surface cotton fabrics described in Table 1 and Table 2. Thirty individual specimens were tested for each fabric and thread combination. The data were then analyzed using box and whisker plots shown in Figure 1 and Figure 2. Any specimen that

REVIEWED OR ACCEPTED BY THE COMMISSION.

did not result in a burn time was excluded from the analysis (*i.e.*, flammability test result codes Did not ignite (DNI) or Ignited, but extinguished (IBE) results, as specified in section 1610.8(b)).

This test program was designed to evaluate how sensitive the time measurements, which are measured to the nearest 0.1 second, are to the properties of the stop thread. The thread's burn time can be affected by its fiber content and its size. To look at the effect of fiber content and size, polyester and cotton threads were chosen for the study with a range of Tex sizes (Table 1).

Fabrics were chosen that had burn times that were between 4-7 seconds and did not produce many DNI or IBE results. This burn time range of 4-7 seconds was chosen because fabrics that burn too quickly or too slowly may not produce the range of measurements necessary to get statistically significant data for comparative evaluation.

Thread ID	Description	Tex (g/1000 meters)
A	Thread Specified in Standard currently used by CPSC	36
В	Commercially available sold as meeting 1610 Standard	44
С	Polyester Core Spun	87
D	Spun Polyester	24
E	Cotton	37

Table 1.	Thread	Descriptions
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Table 2. Fabric Descriptions

Fabric ID	Description	Fabric Weight (oz/yd²)
1	Cotton Organdy	2.06
2	Cotton Batiste	2.06

Comparison Study Results

Figure 1 and Figure 2 show that despite the variation in fiber type and Tex size, the burn times did not vary much, with the median burn times for all thread types being within 0.3 seconds for fabric 2 and 0.4 seconds for fabric 1. Staff notes variability from specimen to specimen within the same fabric type and thread type, with ranges typically around 1.0 second from fastest burning to slowest burning specimen. For fabric 2, nearly all burn times for threads B through E were in the range of burn times observed for thread A, 5.6 - 6.7 seconds (Figure 2). Given these results, it makes sense to broaden the thread description to allow a range of acceptable threads, rather than specify a specific Tex size. A specified range would make it easier for industry to source a thread that meets the specifications and still provide results consistent with the stop thread currently specified in the Standard.



Figure 1. Fabric 1 Box and Whisker Plot for 1610 Burn Times Using Various Threads



Figure 2. Fabric 2 Box and Whisker Plot for 1610 Burn Times Using Various Threads

Discussion

CPSC staff stocks a supply of the thread currently specified in the Standard for consistent compliance testing. However, staff will need to identify an alternative source when the stock is depleted. Furthermore, industry testers must to be able to identify and obtain compliance thread, and the availability of thread that meets the existing specifications is unclear. Staff identified a thread that is currently available on the market that is labeled No. 50. However, the size of the thread has been measured to be 44 Tex, which is not the same as the thread that meets the Standard, which is about 36 Tex. The current specification "No. 50" in the Standard is confusing, making it unclear what type of cotton thread is to be used for testing. To ensure test consistency and clarify the stop thread definition, CPSC staff recommends updating the thread specifications in the Standard because the current thread reference in the Standard is outdated and confusing.

Thread evaluation and current industry practice support a specification using the Tex system. Thread required by Health Canada to meet CAN/CGSB-4.2 No.27.5 is a 35 Tex, 3-ply cotton thread, which is essentially the same as the thread currently used by CPSC staff. Updating the

thread description in 16 CFR part 1610, to match the Canadian description with the addition of 35 Tex and 3-ply, would make the thread specification clearer and specify essentially the same thread currently used by CPSC staff. However, it is unclear whether this specified thread is available on the market.

Data from the thread comparison study showed that there was minimal difference between the burn times for the different threads. Accordingly, staff recommends updating the thread description to specify a Tex range of 35-45 Tex, rather than a specific Tex size as CAN/CGSB-4.2 No.27.5 does. A description with this range is recommended because it would include the current thread used by CPSC (thread A), the thread currently on the market sold for 1610 testing (thread B), and the thread described in the Canadian Standard, CAN/CGSB-4.2 No.27.5 because of the similarity in results in the ranges tested by CPSC staff. Furthermore, specifying a range rather than a specific Tex size makes it easier for industry to source a thread that meets the specifications for 16 CFR part 1610, and thus, reduce burden. Although, the thread comparison study showed that there was minimal difference in burn times between the cotton and polyester threads used in the study, staff recommends that for consistency, the definition of the thread in the Standard should remain cotton and not be expanded to include polyester threads to keep the thread as close as possible to the original thread. Additionally, some polyester threads are designed to be flame resistant, so a cotton thread would be preferred for this application. All three cotton threads tested are within staff's recommended range of 35-45 Tex. Only the polyester threads tested were outside of the recommended range. CPSC staff recommends seeking comments in the NPR about appropriate Tex range and whether a specific Tex size would be preferred.

Recommendation

CPSC staff recommends that the commission initiate rulemaking to update the thread description in sections 1610.2(p) and 1610.5(a)(2)(ii), which currently specify, "No. 50, white, mercerized, 100% cotton sewing thread" and to specify in the rulemaking, "3-ply, white, mercerized, 100% cotton sewing thread, with a Tex size in the range of 35-45 Tex."

Threads that meet this recommended definition are currently available on the market and already sold as meeting 16 CFR part 1610. These recommended changes would clear up confusion over the current definition of No. 50 and encompass the thread definitions in the Canadian Standard, Specifying a Tex range rather than a specific Tex size makes it easier for industry to source a thread that meets the specifications for 16 CFR part 1610, thus reducing burden. Specifying a Tex range is supported by the thread comparison study data that showed the minimal impact of thread size on burn time when testing to the Standard.

Reference

1. Status Update: 16 CFR Part 1610 Rule Update and Consideration for Adding Spandex Fibers to the List of Currently Exempted Fibers from Testing, Tab B: Directorate for Laboratory Sciences Memo on Stop Thread. September 30, 2020.

https://www.cpsc.gov/s3fs-public/StatusUpdate-

16CFRPart1610RuleUpdateandConsiderationforAddingSpandexFiberstotheListofCurrentlyE xemptedFibers-from-Testing.pdf.

Tab D: Memorandum by the Directorate forLaboratory Sciences, Refurbishing Procedure

то:	Paige Witzen, Project Manager, Division of Engineering, Directorate for Laboratory Sciences	DATE: July 6, 2022
THROUGH:	Andrew G. Stadnik, Associate Executive Director Directorate for Laboratory Sciences	
	Allyson Tenney, Director Division of Engineering Directorate for Laboratory Sciences	
FROM:	Emily Maling, Textile Technologist Division of Engineering Directorate for Laboratory Sciences	
SUBJECT:	Comparison Study of Dry Cleaning and Laundering Methods Effect on Flammability for Standard for the Flammability of Clothing Textiles -16 CFR part 1610	

Introduction

The Standard for the Flammability of Clothing Textiles, 16 CFR part 1610 (Standard), issued under the Flammable Fabrics Act (FFA), prescribes methods for flammability testing of textiles used for wearing apparel. The test procedure in the Standard includes a refurbishing procedure in section 1610.6(b). The refurbishing procedure consists of a dry cleaning step, followed by a laundering step, which includes washing and drying. The intent of the refurbishing procedure is to remove any finishes that may affect the flammability of the fabric. The Standard requires that samples be tested in their original state before and also after the specified refurbishing procedure.

There have been some concerns that these specified processes are becoming outdated. The dry cleaning procedure specified in the Standard requires perchloroethylene, which, in recent years, has been subject to increased environmental regulations and plans to ban the use of perchloroethylene for dry cleaning in some states. The washing machine specification in the Standard is already outdated, given that no commercial washers currently on the market are capable of meeting the specification in the Standard. As such, the refurbishing requirement in the Standard needs to be updated so that testing laboratories can continue testing to ensure reliable test results and accurate flammability classifications, which are necessary to keep consumers safe.

Due to the changes in the dry cleaning and washing machine manufacturing industries, staff began researching alternatives and developed and implemented a test plan to compare dry cleaning and laundering methods as an alternative to the current refurbishing process. This memorandum summarizes the test plan and gives recommendations based on the results of the comparison study. For a full analysis of the results, please see the Epidemiology Data Analysis Memorandum in Tab E.

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Dry Cleaning Background

In 2007, California adopted regulations to ban the use of perchloroethylene in the dry cleaning industry by 2023, with additional incremental steps to phase out the use of perchloroethylene before that date.^{1,2} California's ban does not prescribe an alternative method, but the state does offer incentives for carbon dioxide and water-based dry cleaning. Nonetheless, hydrocarbon solvents are becoming the most popular and cost-effective alternatives for the dry cleaning industry because other methods can be more expensive due to high equipment costs and running costs.^{3, 4, 5} Although dry cleaners using perchloroethylene are still available, other states may follow California's example and ban perchloroethylene, thus limiting availability. In addition, the Environmental Protection Agency announced that it is considering steps to address the risks associated with perchloroethylene, including potentially regulating, limiting, or prohibiting production or use of the chemical.⁶ Currently, sections 1610.5(b)(6), 1610.5(b)(7), and 1610.6(b)(1)(i) require a commercial dry cleaners using perchloroethylene would affect testing laboratories' ability to meet the Standard.

Dry Cleaning Options

In light of increasing regulations and bans on perchloroethylene, CPSC staff identified several options to consider for updating the dry cleaning procedure in the Standard, which are listed below:

- 1) Do not change dry cleaning procedure; or
- 2) Change solvent to one of the alternative commercial dry cleaning solvents listed below:
 - a) Hydrocarbon
 - b) Silicone
 - c) Butylal

3) Allow an option to continue to use the current procedure along with an alternative solvent.

From these options a test plan for a comparison study was developed, which is described later in this memorandum.

CPSC staff chose these potential alternatives, partially due to our local availability and their overall general availability in the U.S. market. Hydrocarbon was chosen because it is becoming the most popular and cost-effective alternative for the dry cleaning industry and is more widely available than many of the other alternatives. Silicone and butylal were chosen as additional alternatives due to availability. Carbon dioxide dry cleaning was not chosen because it is more

expensive option and is not as widely available yet. Professional wet cleaning was not chosen as it would add little to the refurbishing procedure as any water-soluble finishes should be removed in the laundering process. As the intent of the refurbishing process is to remove finishes that may affect flammability and the samples are already exposed to a water-based cleaning method under the separate laundering requirements in the Standard, a non-waterbased dry cleaning method would be more consistent with current requirements, and would be more appropriate than professional wet cleaning, given the purpose of the provision.

Dry Cleaning Procedures

The below dry cleaning procedures were chosen for this comparison study. Because of the nature of the different solvent systems, dry cleaning processes, and equipment requirements, more than just the solvent needs to be changed when switching from one solvent to another. As such, the detergent class, cleaning time, extraction time, cooling time, drying time, and drying temperature, were all chosen in the procedures below to reflect typical procedures used for that solvent system by commercial dry cleaners.

In all procedures, samples were dry cleaned in a commercial dry cleaning machine at 80 percent of the machine's capacity using one of the following methods described below. Eighty percent wool 20 percent cotton ballast was used in addition to the sample to achieve 80 percent machine capacity.

Current Perchloroethylene Dry Cleaning Procedure Section 1610.6(b)(i)(A), Option 1

Solvent: Perchloroethylene Detergent Class: Cationic Cleaning Time: 10-15 minutes Extraction Time: 3 minutes Drying Temperature: 60-66°C (140-150°F) Drying Time: 18-20 minutes Cool Down/Deodorization Time: 5 minutes

Hydrocarbon Dry Cleaning Procedure, Option 2a

Solvent: Hydrocarbon Detergent Class: Cationic Cleaning Time: 20-25 minutes Extraction Time: 4 minutes Drying Temperature: 60-66°C (140-150°F) Drying Time: 20-25 minutes Cool Down/Deodorization Time: 5 minutes

Silicone Dry Cleaning Procedure, Option 2b

Solvent: Silicone Detergent Class: Anionic Cleaning Time: 14-17 minutes Extraction Time: 6 minutes Drying Temperature: 70°C (158°F) Drying Time: 18-20 minutes Cool Down/Deodorization Time: 5 minutes

Butylal Dry Cleaning Procedure, Option 2c

Solvent: Butylal Detergent Class: Cationic Cleaning Time: 2 mins (bath 1), 11 minutes (bath 2), (13 minutes total) Extraction Time: 5 minutes (bath 1), 5 minutes (bath 2), (10 minutes total) Drying Temperature: 66-71 °C (150-160 °F) Drying Time: 40 minutes Cool Down/Deodorization Time: 4 minutes

Laundering Background

On March 25, 2008, the Commission published a final rule in the *Federal Register*, which updated the laundering procedure in part 1610 to incorporate by reference the American Association of Textile Chemists and Colorists (AATCC) standard, AATCC TM 124-2006, Appearance of Fabrics After Repeated Home Laundering (73 FR 15636).⁷ This was the first machine washing procedure in the Standard; previously, the Standard had used a hand washing procedure. Accordingly, the current laundering procedure in section 1610.6(b)(1)(ii) requires that, after subjecting a sample to the dry cleaning procedures, it must be washed and dried in accordance with provisions in AATCC TM 124-2006, before flammability testing. The machine washing procedure in AATCC TM 124-2006 specifies using a washing machine that can meet the parameters for agitation speed, water level, wash temperature, wash time, rinse time, spin speed, and spin time described in Table 1 Option 1. For machine drying, AATCC TM 124-2006 specifies the dryer exhaust temperature and the cool down time.

Currently, "laundering" is defined in the Standard at 1610.2(i). In the Standard, "laundering" means washing with an aqueous detergent solution and includes rinsing, extracting and tumble

drying, as described in § 1610.6. Throughout this memorandum, the term *laundering* is used according to this definition of the term.

Washing Background

Home washing machines have changed substantially over the past 15 years, to reduce water use and make machines more energy efficient. As washing machines changed with the development of high-efficiency machines, AATCC updated their TM 124 standard in 2009, 2010, 2011, 2014, and 2018.⁸ In each of these revisions the washing machine specifications were changed to align with the specifications of new machines on the market. Most notably, the agitation speed was reduced significantly in later revisions. It is this agitation speed parameter in TM 124-2006, referenced in 16 CFR part 1610, that washing machines produced today cannot meet. In 2010 and 2011 versions of TM 124, the table specifying the washing machine parameters, was removed and the reader was directed to reference AATCC Monograph 6 "Standardization of Home Laundry Test Conditions" for these specifications. The reference to Monograph 6 was later replaced by AATCC Laboratory Procedure 1 – Home Laundering: Machine Washing (LP1), which was first published in 2018, and later revised in 2021.9 In the 2018 version of TM 124, a table specifying washing machine parameters was added back into the standard. This table with washing machine parameters is identical to the table 1 in LP1. As AATCC TM 124 is not just a laundering standard, but it also has procedures for evaluating the smoothness appearance of fabrics, it would be preferable to reference LP1 in the standard, and for evaluation in this study, instead of the updated version of TM 124-2018.

Laboratory Procedure 1 – Home Laundering: Machine Washing (LP1) includes procedures and washing machine specifications recommended in its Table I -Standard Washing Machine Parameters, as well as historical alternative washing machine parameters in tables IIA through IVB. Table IIA – Alternate Laundering Parameters (Traditional Top-loading Machines 2000-2008) of LP1 includes parameters identical to the current 1610 Standard laundering procedure under options Normal, Hot, even though there are no currently available machines that meet these parameters. The recommended washing machine parameter in LP1 Table I, and the current 1610 laundering method, differ in several parameters, including water level, wash time, spin speed, spin time, and most notably, agitation speed (Table 1).

As noted above, washing machines manufactured and marketed currently (and increasingly over the past 15 years), cannot meet the agitation speed parameter in TM 124-2006, referenced in the Standard. Although CPSC still has washing machines that meet this parameter, when these machines reach the end of their useful life, CPSC will not be able to replace them with a machine that complies with the current provisions in the Standard; nor can they assess compliance for testing laboratories that use such machines. This is also the case for testing laboratories; because fewer washing machines that meet these parameters have been produced over the years, CPSC expects that many of these machines have or soon will reach the end of their useful lives. To consider alternative washing machines that are currently available on the market, CPSC recently purchased a new washing machine designed for testing

laboratories. This machine offers preprogramed wash cycles meeting AATCC's LP1 Table I, and additionally, it allows the user to program their own cycle parameters, subject to the machine's physical specification limits. This programming feature allows for greater control and customization. All machine-programmable cycle parameters, except the agitation speed, can meet the current laundering requirements specified in 16 CFR part 1610. The current Standard requires an agitation speed of 179 strokes per minute (spm), while the maximum programmable agitation speed for the newly purchased programmable washer is 120 spm (Table 1). However, LP1 currently does not consider the differences in stroke length. Stroke length is a measurement of the degrees of rotation of the agitation speeds. Newer machines have stroke lengths of up to 90 degrees and higher agitation speeds. Newer machines have stroke lengths of up to 220 degrees that can achieve the same wash results with lower agitation speed. Thus, the agitation speed alone cannot be used as a measure of how rough the wash cycle is on the textiles. Rather, stroke length and agitation speed must be considered in combination when comparing washing parameters.

Drying Background

The second stage of refurbishment, laundering, requires the use of an automatic washing machine and tumble dryer. Unlike washing machines, there has been little change in the designs of clothes dryers in recent years, and dryers that meet the current requirements are still available. However, there are slight differences in the clothes dryer specifications in 16 CFR part 1610 and current voluntary standards. In section 16 CFR § 1610.6(b)(1)(ii), the Standard currently references the "Durable Press" conditions in AATCC TM 124-2006, which specify a dryer exhaust temperature of 66 ± 5 °C. Both the current version of TM 124, TM 124-2018, and LP1 use updated terminology of "Permanent Press" instead of "Durable Press" and specify a maximum dryer exhaust temperature of 68 ± 6 °C. These ranges overlap substantially, differing by only a few degrees, and thus, many dryers are actually able to meet both specifications.

Laundering Options

Staff identified several options to consider for updating the laundering (washing and drying) procedure in the Standard, which are listed below:

- 1) Make no change to washing and drying options (not recommended because washing machines not currently available);
- 2) Reduce required agitation speed from 179 spm to 120 spm, for washing option, keeping other washing parameters the same, and not changing the drying parameters; or
- Adopt AATCC Laboratory Procedure 1 Table I suggested by AATCC, which further reduces agitation speed to 86 spm, along with changes to other parameters noted in Table 1, including changes to dryer exhaust temperature.

From these options, a test plan for a comparison study was developed, which is described later in this memorandum.

Option 2, reduced agitation speed, was chosen for evaluation because it is the closest option to the current method that modern programmable washing machines manufactured today are able to achieve, as only one of the washing parameters is changed from the current method.

Option 3, LP1 Table I, (1) Normal, (IV) Hot, was recommended in a comment in response to the Request for Information (RFI) in the *Federal Register* on April 23, 2019, seeking comment on laundering procedures for 16 CFR part 1610 (84 FR 16797).¹⁰ LP1 is a current voluntary standard that some testing laboratories are already using for other voluntary standards testing. The newer version of the currently referenced method, TM 124-2018, was not considered, as its washing machine parameters are identical to LP1, which it references, and it is not solely a laundering standard, but also describes evaluation of smoothness appearance of fabrics after home laundering, which is irrelevant to the flammability standard, 16 CFR part 1610.

Table 1: Laundering Procedure Parameters

	Option 1:	Option 2:	Option 3:
	Current Standard 16 CFR part	Agitation Reduction	AATCC LP1 Table I, (1) Normal, (IV) Hot
	1610''		Table VI, (Aiii) Permanent Press ¹²
Washing Machine Parameters			
Agitation Speed, strokes/min	179 ± 2	120 ± 2	86 ± 2
Water Level, L (gal)	68 ± 4 (18 ± 1)	68 ± 4 (18 ± 1)	72 ± 4 (19 ± 1)
Washing Time, min	12	12	16 ± 1
Spin Speed, rpm	645 ± 15	645 ± 15	660 ± 15
Final Spin Time, min	6	6	5 ± 1
Wash Temperature, °C (°F)	49 ± 3 (120 ± 5)	49 ± 3 (120 ± 5)	49 ± 3 (120 ± 5)
Load size, kg (lbs)	≤ 3.63 (≤ 8)	≤ 3.63 (≤ 8)	1.8 ± 0.1 (4 ± 0.2)
AATCC 1993 Standard Reference Detergent, g (oz)	66 ± 0.1 (2.3 ± 0.004)	66 ± 0.1 (2.3 ± 0.004)	66 ± 1 (2.3 ± 0.004)
Dryer Parameters			
Max. Dryer Exhaust Temperature, °C (°F)	66 ± 5	66 ± 5	68 ± 6
Cool Down Time, min	10	10	≤10

Comparison Study Description

Staff developed a comparison testing study to evaluate the laundering and dry cleaning options listed above.

Staff selected 11 fabrics, consisting of 6 plain surface fabrics and 5 raised surface fabrics, to use in the study to evaluate 6 different dry cleaning and laundering options, including the current refurbishing procedure. For each of the three new dry cleaning options, the current standard laundering method was used so that only one process variable was changing and the effects of the different dry cleaning methods on flammability testing results could easily be compared.

Similarly, for each of the two new laundering procedure options, the current perchloroethylene dry cleaning procedure was used.

These 11 fabrics were selected to be representative of fabrics that typically require flammability testing, both plain and raised surface, with both passing and failing results. The Standard provides different criteria for plain surface and raised surface fabrics to determine the classification and acceptability for use in clothing. Therefore, both plain and raised surface fabrics were included in the comparison study. Fabric details are listed in Table 2. Fabrics made of fibers that are not exempt from testing under section 1610.1(d)(2), such as silk, cotton, and rayon, were chosen. For plain surface fabrics, light weight fabrics that are not exempt under section 1610.1(d)(1) were chosen. To keep the study simple, no blends were used.

At least 14 yards of each fabric with widths varying from 40 to 60 inches, were purchased, and cut into four, 2-yard sections and one 6-yard section (Table 2 and Table 3). One of the 2-yard sections was tested for flammability according to 1610, as received. The 6-yard section was dry cleaned in perchloroethylene, and the other three, 2-yard sections were dry cleaned in hydrocarbon, silicone, or butylal solvents (Table 3). After dry cleaning, each of these 2-yard sections was washed separately, according to the current laundering procedure in part 1610. The 6 yard section, after dry cleaning in perchloroethylene, was cut into three, 2-yard sections, each for a different laundering procedure. One was laundered to the current part 1610 laundering method (Table 1, Option 1), one laundered according to LP1 Table I (1) Normal (IV) Hot (Table 1, Option 3), and one laundered with the reduced agitation speed (Table 1 Option 2). Thirty, 2-inch by 6-inch specimens were then cut from each 2-yard fabric section for flammability testing, according to section 1610.6(c), after the specimen direction was determined by preliminary tests to determine quickest burning direction according to section 1610.6(a)(2)(i) for plain surface fabrics and section 1610.6(a)(3)(i) for raised surface fabrics.

The 30 specimens were then mounted in test frames and raised surface samples were brushed according to section 1610.6(a)(2)(iii) for plain surface fabrics and section 1610.(a)(3)(iii-iv) for raised surface fabrics. All specimens were conditioned in an oven at 105° C for 30 minutes and then placed in a desiccator until cool before testing, according to section 16 CFR section 1610.6(a)(2)(iv) and section 16 CFR section 1610.6(a)(3)(v). All specimens were then tested for flammability according to section 1610.6(c), which describes the 45° -angle burn test, where a flame is applied for 1 second and the specimen allowed to burn until the stop thread^{*} is broken, which stops the timing device. The burn time and applicable test result codes from section 1610.8(b) were recorded. A total of 2310 specimens were tested from all 11 fabrics with different refurbishing procedures, as shown in Table 4.

* The historical stop thread used by CPSC was used for all testing in this comparison study.

Fabric ID	Fabric Description	Fabric Weight (oz/yd ²)	Surface Type (Plain or Raised)	Approximate Fabric Width (cm)
А	Silk, Chiffon, White	0.58	Plain	112
В	Silk, Habutae, White	1.06	Plain	114
С	Silk, Chiffon, Black	0.87	Plain	112
D	Rayon, Chiffon, white	2.0	Plain	137
E	Cotton, Batiste	2.06	Plain	114
F	Cotton, Organdy	2.06	Plain	152
G	Cotton, Brushed, White	7.24	Raised	100
Н	Cotton Terry	9.02	Raised	152
1	Cotton, Chenille, White	10.0	Raised	142
J	Cotton, Chenille, Black	10.0	Raised	142
К	Rayon, Brushed, Black	3.08	Raised	152

Table 2: Comparison Study Fabric Descriptions

Table 3: Fabric Preparation Process

Refurbishing	1) Current	2) LP1 Table I	3) Agitation	4) Hydrocarbon	5) Silicone	6) Butylal	None,
Process		(1) Normal	Reduction				As Received
Fabric		(IV) Hot					
Prep Step							
As Received			Star	ting Fabric (14 yar	ds)		
Dry Cleaning	Perc	hloroethylene (6 y	ards)	HydroC (2 yards)	Silicone (2 yards)	Butylal (2 yards)	None (2 yards)
Laundering	Current (2 yards)	LP1 (2 yards)	Agit (2 yards)	Current (2 yards)	Current (2 yards)	Current (2 yards)	None (2 yards)
	30 specimens	30 specimens	30 specimens	30 specimens	30 specimens	30 specimens	30 specimens
Cut Specimens	(2 by 6 inches)	(2 by 6 inches)	(2 by 6 inches)	(2 by 6 inches)	(2 by 6 inches)	(2 by 6 inches)	(2 by 6 inches)

Note: Vertical lines indicate cuts made to the starting 14 yards of fabric. Table shows the flow of the fabric preparation process from top to bottom, with each box leading to all the boxes beneath it.

Fabric	Plain/ Raised	Original State	Existing Perchloroethylene Dry Cleaning			Hydrocarbon Dry Cleaning (Option 2a)	Silicone Dry cleaning (Option 2b)	Butylal Dry Cleaning (Option 2c)	Total Specimens Tested
			Existing 1610 Laundering (Option 1)	Agitation Speed Change (Option 2)	AATCC LP1 (Option 3)	E	xisting 1610 Launderi	ng	
A	Plain	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	210
В	Plain	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	210
С	Plain	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	210
D	Plain	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	210
E	Plain	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	210
F	Plain	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	210
G	Raised	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	210
Н	Raised	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	210
Ι	Raised	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	210
J	Raised	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	210
К	Raised	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	30 Specimens	210
Total Specimens Tested		330	330	330	330	330	330	330	2310

Table 4: Test Matrix for Comparison Study of Refurbishing Procedures Effect on Flammability

Key:

Green: Dry Cleaning Method; Blue: Laundering Method; Orange: No Refurbishing (Original State)

Comparison Study Results, Recommendations and Discussion

As seen in the analysis of the study data in the Epidemiology Memorandum in Tab E, there was little difference in flammability test results and fabric classifications between the alternate dry cleaning options (hydrocarbon, silicone, and butylal) when compared with the current method. As perchloroethylene is still widely used and available at this time, staff recommends adding an additional option for dry cleaning to the 1610 Standard, while keeping the current option. This would allow testing laboratories in states that plan to ban perchloroethylene alternate dry cleaning options. By adding an option to the current standard, there is no additional cost or burden associated with this change, and the additional option decreases burdens where perchloroethylene dry cleaning is not readily available.

Staff recommends selecting hydrocarbon solvent as the additional dry cleaning option, because hydrocarbon has been available longer than other alternatives tested and is the most commonly used alternative to perchloroethylene.¹³ Although perchloroethylene still makes up the majority with estimates of 60 percent to 65 percent of dry cleaners still using perchloroethylene, hydrocarbon solvents are estimated to be used by 20 percent to 25 percent of dry cleaners, while other perchloroethylene alternatives combined make up only 15 percent to 20 percent of dry cleaners.¹³ Several companies manufacture high-flash-point hydrocarbon solvents for dry cleaning, while silicone and butylal are newer technologies that are patented. CPSC staff recommends requesting comment in the NPR on all alternate options considered.

Similarly, for the laundering alternatives, the Epidemiology Memorandum in Tab E shows that there was little difference in flammability test results and fabric classifications between the new laundering methods (LP1 and reduced agitation speed) when compared with the current method. Given all three methods are basically equivalent, staff recommends that Table 1 Option 3. AATCC Laboratory Procedure 1 – Home Laundering: Machine Washing (LP1) Table I (1) Normal (IV) Hot, Table VI (Aiii) Permanent Press be adopted as the new washing and drying standard for part 1610. Staff also recommends replacing the reference to sections 8.2.2 and 8.2.3 in TM 124, with reference to sections 9.2 and 9.4 in LP1, because they include equivalent procedures. Section 9.2 specifies a smaller wash load size (1.8 +/- 0.1kg) than the current Standard, which allows for any size load up to the 8 lbs maximum. Staff recommends reducing the maximum load size to be consistent with the load size specified in LP1, for which the washing machines are designed. Referencing LP1 directly, rather than through the updated version of TM 124, the currently referenced standard, is preferable because it is specifically a washing standard. LP1 (Table1, option 3) is preferable over the current method (Table 1, Option 1), because washing machines that meet these specifications are currently available to purchase, while no commercially available machines meet the current part 1610 washing machine parameters. LP1 (Table 1, Option 3) is also preferable to the reduced agitation option (Table 1, Option 2), because it is already a standard that is used by testing laboratories to launder samples for other tests. There are also more washing machines available that meet the

washing machine specifications of LP1 Table I (1) Normal (IV) Hot (Table 1, Option 3), than meet the specification for the reduced agitation option (Table 1, Option 2). It is likely that only programable washing machines, where the agitation speed can be set by the user, will be able to meet the parameters for the reduced agitation speed option (Table 1, Option 2), while both programable machines and machines with set parameters built to meet LP1 Table I specifications are available that meet LP1 (Table 1, Option 3). CPSC staff recommends requesting comments in the NPR on both alternate options considered.

In addition to the washing requirements, CPSC staff also recommends updating the drying requirements to match those in LP1 Table VI (Aiii) Permanent Press, because these changes are minimal, and staff recommends replacing the reference to section 8.3.1(A) in TM 124 with reference to section 12.2(A) in LP1 because they include equivalent procedures. The temperature ranges of the current dryer exhaust temperature, at 66 ± 5 °C, and the recommended dryer exhaust temperature in LP1, at 68 ± 6 °C, overlap substantially, differing only by a few degrees. Because of this overlap, we would expect that many clothes dryers designed to meet the current Standard would also be able to meet the new standard, given most machines would be designed to target the middle of the range at 66 °C, and few machines would fall in the lowest 1 degree of the current range (61-62 °C), which is outside the range specified in LP1 of 68 ± 6 °C. Updating the washing machine reference in the Standard without updating the dryer reference would require testing laboratories to acquire and reference two separate standards, which is more cumbersome and costly. CPSC staff recommends requesting comments in the NPR on the burden of the recommended dryer change.

CPSC staff recommends adding an alternative option for dry cleaning because the current option using perchloroethylene is still widely used. For laundering, staff recommends replacing the current option because this has been outdated for a number of years and machines meeting the washing requirements are no longer available for purchase. Testing laboratories that still use older washing machines and clothes dryers meeting the current Standard will be able to continue to do so as section 1610.40 allows for the use of alternative apparatus and procedures, if the alternative is equivalent or more stringent than the Standard. This briefing package, including the Epidemiology Memorandum in Tab E, gives data to support equivalency of the methods tested.

Conclusions and Recommendations

CPSC staff recommends revising the dry cleaning and laundering requirements in the Standard because the future availability of the specified dry cleaning solvent, perchloroethylene, is uncertain and will be prohibited in certain areas in the near future; in addition, washing machines meeting the requirements of the Standard are unavailable. Given that results of the comparison testing study showed that the alternatives tested had little effect on the flammability testing results, staff recommends adopting LP1 (Table 1, Option 3) as the new washing and

drying procedure because it is already a standard used by industry and testing laboratories. Given that perchloroethylene is being phased-out in some states, yet is still widely available elsewhere, staff recommends adding an additional dry cleaning option to the standard, while allowing the existing perchloroethylene dry cleaning procedure to continue to be used. Staff proposes selecting the hydrocarbon dry cleaning procedure as the alternative, since it is one of the most common alternatives to perchloroethylene and is cheaper than the other alternatives.

Dry Cleaning Recommendations

Staff recommends issuing an NPR to add a hydrocarbon dry cleaning procedure as an alternative option, while keeping the existing perchloroethylene dry cleaning procedure, because perchloroethylene is still widely used.

Laundering Recommendations

Staff recommends issuing an NPR to replace the existing laundering procedure with LP1 Table I (1) Normal (IV) Hot for washing and LP1 Table VI (Aiii) Permanent Press for drying (Table 1, Option 3) because washing machines that meet the current specification are unavailable.

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Tab E: Memorandum by the Directorate forEpidemiology, Refurbishing Procedure DataAnalysis

TO:	Paige Witzen, Project Manager, Division of Engineering, Directorate for Laboratory Sciences	DATE: July 6, 2022
THROUGH:	Stephen Hanway, Associate Executive Director, Directorate for Epidemiology	
	Risana Chowdhury, Director, Division of Hazard Analysis, Directorate for Epidemiology	
FROM:	Tammy Massie, Statistician Division of Hazard Analysis	
SUBJECT:	Flammability Testing and Results Comparing Five (5) Possible Alternatives to the Current 16 CFR Part 1610 Laundering and Dry Cleaning Procedures	

Purpose

This memorandum presents summary results from a statistical analysis based on laboratory testing data to establish the equivalence¹ of several laundering procedures and dry cleaning refurbishment procedures that staff recommends updating in 16 CFR part 1610, Standard for the Flammability of Clothing Textiles.

Background

As part of its authority under the Flammable Fabrics Act (FFA), the U.S. Consumer Product Safety Commission (CPSC) codified the Standard for the Flammability of Clothing Textiles at 16 CFR part 1610. Textile fabrics and related material in a form or ready for use in an article of wearing apparel are required to meet the standard (16 CFR § 1610.1(e)). The standard provides a method of testing the flammability of clothing textiles, establishes three classes of flammability, and specifies whether each class can be used for clothing. The standard also exempts certain fibers from flammability testing, based on a history of consistently acceptable test results.

The test procedure generally involves placing a specimen in the test apparatus, stringing the stop thread across the top of the specimen, activating a trigger device that impinges a flame, and recording the time it takes to sever the stop thread and observations of the burn behavior of the specimen. This test is performed before and after refurbishing the sample, which involves specified methods of dry cleaning and laundering. After testing, the burn time (*i.e.*, the time

¹ Note: Statistical equivalence does NOT mean identical, it means the difference is less than some predetermined difference delta " Δ ."

elapsed from ignition until the stop thread is severed) and burn behavior are used to determine the classification of the textile, which determines whether the textile is acceptable for use in clothing. The criteria for each classification differ for plain surface textile fabrics and raised surface textile fabrics. For plain surface fabrics, the main consideration for classifying them as Class 1, acceptable, and Class 3, not acceptable, is the burn time, with a burn time of less than 3.5 seconds being Class 3. While for raised surface fabrics, which exhibit surface flash, the burn behavior is also considered with the burn time. The consideration of burn behavior is needed in this case because a rapid surface flash that quickly breaks the stop thread but does not burn through the base of the fabric, is not considered to be dangerously flammable. It is the combination of burning rapidly and through the base that results in a dangerously flammable fabric.

CPSC has considered various pathways to update 16 CFR part 1610. In this draft notice of proposed rulemaking (NPR), staff has identified one category of potential changes, updating equipment and procedural requirements in the standard to provide greater clarity and allow for easier compliance.

The tabulations and figures presented in this memorandum are based on laboratory testing data from burn characteristics of both plain and raised surface fabrics using two new laundering procedures and three new dry cleaning procedures, which are compared to the current part 1610 procedures. The descriptive statistics and statistical comparisons based on the data collected help provide evidence to support updates to the refurbishing procedures in part 1610.

Proposed New Refurbishing Procedures

The comparison of dry cleaning and laundering procedures includes the current procedures, as well as the five alternative refurbishing procedures (3 for dry cleaning and 2 for laundering). More details regarding each of these procedures are explained in Tab D: Comparison Study of Dry Cleaning and Laundering Methods Effect on Flammability for Standard for the Flammability of Clothing Textiles -16 CFR part 1610. Both the laundering procedures and the dry cleaning procedures are compared to the same data points for the 30 specimens refurbished using the current part 1610 procedure; however, for ease of examination, the different procedures are separated into the laundering or the dry cleaning procedure, as illustrated in Table 1).

Laundering	Dry Cleaning									
Current Procedure (*)										
LP1	Hydrocarbon (HydroC)									
Agit	Silicone (Siloco)									
	Butylal (BU)									

Table 1) Refurbishing Procedures for both the current 1610 procedure and the recommendedLaundering and Dry Cleaning Procedures

(*) Note: The comparator of "current" is the same procedures and includes the same 30 data points collected using the current 1610 refurbishment procedure for both the laundering and dry cleaning.

The details of the specific laundering procedures can be found in Tab D. To summarize, Agit reduces the agitation speed parameter compared to the current method, while LP1 changes multiple washing parameters, including agitation speed, water level, washing time, spin speed, and spin time. (LP1 means the 2021 version of the American Association of Textile Chemists and Colorists (AATCC) standard Laboratory Procedure 1 – Home Laundering: Machine Washing. See Tab D for details about the specific provisions of LP1.)

The alternative dry cleaning procedures tested, Hydrocarbon (HydroC), Silicone (Silico) and Butylal (BU), represent changes to the solvent used within the dry cleaning procedure. As the dry cleaning process and equipment requirements are different for each solvent system, additional parameters need to be changed, including detergent class, cleaning time, extraction time, drying temperature, drying time, and cool down time. Details of these procedures can be found in Tab D.

For each of the refurbishing procedure tests, the primary outcome of interest is the burn time, as determined using the procedure in part 1610 (*i.e.*, the time from when an ignition source was administered until the fabric specimen burned and released a weight held by the stop thread). This is a measure to indicate how flammable a textile fabric is. Some of the fabric specimens did not ignite and burn through after the ignition source was administered and were labeled: "Did Not Ignite" or DNI. More details related to these procedures and assessments are explained in Tab D, which describes the refurbishing procedures in detail.

LSE lab staff tested 30 replicates of 11 different fabric types (referred to as Fabric A-K in this memorandum) for each refurbishing procedure. The 11 textile fabrics were divided into "Plain Surface" and "Raised Surface," which had different criteria of success, based on the parameters for determining classifications in the standard.

"Plain Surface" textile fabrics have a criterion of success/passing based on burn rate of 3.5 seconds or more or "DNI."

1. Pass – the fabric ignited, and the burn time was 3.5 seconds or more.

- 2. DNI ignition of the fabric did not occur.
- 3. Failure burn time was less than 3.5 seconds.

"Raised Surface" textile fabrics have four observed outcomes for the burn codes, which are listed below and described in section 1610.8(b)(2). These burn codes, in conjunction with any burn times, are used to classify fabrics. Class 3 raised surface fabrics, which are not acceptable for use in clothing, have an average burn time of less than 4 seconds and the base fabric starts burning at places other than the point of impingement as a result of the surface flash (*i.e.*, test result code SFBB), as described in section 1610.4(c)(2).

The raised surface burn codes observed are as follows:

- 1. SFpoi
- 2. SFBBpoi
- 3. SFBBpoi*
- 4. SFBB

Since the criteria for success/pass are different for plain surface textile fabric than for raised surface textile fabric (see section 1610.4), this memorandum examines the data by fabric type separately. Plain surface fabric is presented first, denoted by fabric A-F, and the raised surface fabric, denoted by fabric G-K, is presented next.

Although the criteria for success/passing are different for the plain surface versus raised surface fabric textiles, the study plan incorporates or summarizes both time to event (burning through the stop thread), as well as dichotomous Pass/Fail endpoints for all fabric styles.

Background of Study Design

To compare the refurbishing procedures on both plain surface (6) and raised surface (5) fabrics, staff identified and purchased 14 yards of each unique fabric. Staff cut each piece of fabric into seven single, 2-yard pieces. Six of these large, 2-yard swatches were dry cleaned and laundered following the standard and the new procedures being considered (as appropriate)— Current, LP1, Agit, HydroC, Silicone and BU—while one of the original pieces remained unlaundered but was also tested to determine the burn time. The unlaundered fabric is not discussed in this memorandum.

After completing the six alternative refurbishing procedures, staff cut each 2-yard piece of fabric into 30 identical specimens ready for flammability testing. For each of the 11 fabrics and six different refurbishing procedures, the flammability for each of the 30 unique specimens was tested according to section 1610.6(c) and the burn code and burn time were noted. The laundering and dry cleaning procedures were set up as summarized in Table 2), below, with the current part 1610 procedure noted as "**1**) **Current**" for both laundering and dry cleaning fabric

procedures. Table 2) provides insight into the method for creation of samples and test procedures.

Table 2) Fabric Refurbishing Pr	reparation Process
---------------------------------	--------------------

Refurbishing	1) Current	2) LP1 Table I	3) Agitation	4) Hydrocarbon	5) Silicone	6) Butylal	None,
Process		(1) Normal	Reduction				As Received
Fabric		(IV) Hot					
Prep Step 📃							
As Received			Star	ting Fabric (14 yar	ds)		_
Dry Cleaning	Perc	hloroethylene (6 y	ards)	HydroC (2 yards)	Silicone (2 yards)	Butylal (2 yards)	None (2 yards)
Laundering	Current (2 yards)	LP1 (2 yards)	Agit (2 yards)	Current (2 yards)	Current (2 yards)	Current (2 yards)	None (2 yards)
	30 specimens	30 specimens	30 specimens	30 specimens	30 specimens	30 specimens	30 specimens
Cut Specimens	(2 by 6 inches)	(2 by 6 inches)	(2 by 6 inches)	(2 by 6 inches)	(2 by 6 inches)	(2 by 6 inches)	(2 by 6 inches)

Plain Surface Fabric

The plain surface fabric tested by LSE staff included six unique fabric types noted by the fabric identification of A-F. Table 3) provides a brief summary of the type of both the plain fabric and raised fabric.

Fabric ID	Fabric Description	Fabric Weight (oz/yd ²)	Surface Type(Plain or Raised)
А	Silk, Chiffon, White	0.58	Plain
В	Silk, Habutae, White	1.06	Plain
С	Silk, Chiffon, Black	0.87	Plain
D	Rayon, Chiffon, white	2.0	Plain
E	Cotton, Batiste	2.06	Plain
F	Cotton, Organdy	2.06	Plain
G	Cotton, Brushed, White	7.24	Raised
Н	Cotton Terry	9.02	Raised
Ι	Cotton, Chenille, White	10.0	Raised
J	Cotton, Chenille, Black	10.0	Raised
К	Rayon, Brushed, Black	3.08	Raised

 Table 3) Summary of Plain and Raised Fabric Types

The results from the burn times and burn patterns are analyzed below, first for the plain fabrics, and then for the raised fabrics.

Staff examined burn times for all plain surface fabrics tested. The descriptive statistics and potential trends, including figures and tables representing the data collected within this study, are presented in this memorandum in a consistent order. First, staff considered the means of the time to event (*i.e.*, burn time, in seconds). The numerical value of time in seconds is presented for all specimens that had a burn time noted. Comparisons of the count, the mean, standard deviation, and range for all fabrics are provided in tabular form for the laundering procedures and the dry cleaning procedures. For any fabric specimens that did not ignite (DNI), the burn time is not indicated, because none was observed or noted.

Second, tables that incorporate the Pass, DNI, and failure rate are presented. These tables compare each of the five considered procedures to the current part 1610 method. Since all plain surface fabric specimen passed or were noted to be DNI, these tables are all 2 x 2 tables and encompass the specific plain surface fabric (fabric A-G) and refurbishing procedure. In the case of raised fabric, four potential outcomes related to burn patterns were observed, and the summary tables comparing the different laundering and dry cleaning procedures are presented.

Third, time to event survival curves present a comparison of all five refurbishing procedures in which burn times were noted. Time to event curves can identify if refurbishing procedure led to burn times that are faster or slower than other refurbishing procedures, with comparisons of the current 1610 standard of specific interest. For these graphics, only results that noted a specific burn time are included.

Fourth, stem and whisker boxplots illustrate the mean, median, and quantiles (the 25th percentile and 75th percentile) of observed burn times for the different refurbishing procedures.

Plain Surface Results

The results of burn time comparison of the laundering and dry cleaning procedures for all plain surface fabrics (Fabrics A-F) are presented and discussed below.

Tables 4a and 4b provide the mean burn time for all plain surface fabric specimen that ignited and had a burn time collected.

Table 4a) provides the burn time information for the three laundering procedure options. The current laundering procedure included 104 fabric specimens from all the plain surface fabric specimen tested (180). The 104 specimens with a burn time collected have a mean burn time of 6.15 seconds, a standard deviation of 0.77 seconds, with a range of 4.70 to 8.10 seconds. This can be compared to the LP1 results, which included 86 fabric specimens that ignited, which had a mean burn time of 6.12 seconds, a standard deviation of 0.92 seconds, and a range of 4.60 to 9.50 seconds. The 126 (out of 180) Agit specimens ignited with a mean burn time of

6.25 seconds, a standard deviation of 0.71 seconds, and a range of 4.80 to 8.20 seconds. These results indicate that the mean burn times for all three laundering procedures were very similar, suggesting that both LP1 and AGIT provide burn times comparable to the current standard.

Table 4a) Descriptive Statistics of Burn Time (in seconds) Laundering Procedure for All Plain

 Surface Fabrics

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	104	6.15	0.77	4.70	8.10
LP1	86	6.21	0.92	4.60	9.50
AGIT	126	6.25	0.71	4.80	8.20

Table 4b) provides the burn time information for the four dry cleaning procedure options. The current dry cleaning procedure included burn times for 104 fabric specimens from all of the plain surface fabric specimen tested (180). The current part 1610 procedure has the same 104 specimens noted in Table 4b) with a burn time collected and have a mean burn time of 6.15 seconds, a standard deviation of 0.77 seconds and a range of 4.70 to 8.10 seconds. This can be compared to the HydroC results, which included 94 fabric specimens that ignited with a mean burn time of 6.05 seconds, a standard deviation of 0.88 seconds and a range of 4.90 to 9.40 seconds. The Silico had 86 (out of 180) fabric specimens that ignited, which had a mean burn time of 6.15 seconds, a standard deviation of 0.88 seconds and a range of 4.80 to 9.40 seconds. The 115 (out of 180) Bu specimens ignited with a mean burn time of 6.09 seconds, a standard deviation of 0.790 seconds. These results indicate that the mean burn times for all four dry cleaning procedures were very similar, suggesting that HydroC, Silico, and BU provide burn times comparable to the current standard.

Table 4b) Descriptive Statistics of Burn Time (in seconds) Dry Cleaning Procedure for All Plain Surface Fabrics

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	104	6.15	0.77	4.70	8.10
HYDROC	94	6.05	0.88	4.90	9.40
SILICO	86	6.15	0.88	4.80	8.90
BU	115	6.09	0.77	4.80	7.90

(*) Note the comparator of interest is the current refurbishing procedure, and the study data for the current procedure is the comparator to the laundering and dry cleaning procedures.

A general observation from the results of the mean, standard deviation and range suggests there may be small differences between the various laundering or dry cleaning procedures'

effects on burn time when compared to the current part 1610 procedure, but these differences are very minimal.

In addition to considering mean burn times, staff also reviewed general passing results, based on burn times, and the number of DNI results. For plain surface fabrics, a burn time of 3.5 seconds or more qualifies as Class 1 and is permissible for use in clothing; these results are denoted as "Pass" in the results presented below. Staff also assessed, and presented separately, DNI results. DNI indicates that the specimen did not ignite, and therefore, had no burn time to record. For plain surface fabrics, a result of DNI generally means the fabric is Class 1 and permissible for use in clothing (although, if different specimen of the same fabric yielded non-DNI results, the Class would be based on those results). Accordingly, for the results presented below for plain surface fabrics, a result of "Pass" or DNI both indicate that the specimen would qualify as Class 1 under the standard. In this memorandum, staff refers to these combined "Pass"/DNI results as "Global Pass." However, staff presents DNI results separately in this analysis, because DNI results have more limited utility for comparisons in other analyses since they do not provide a burn time. The comparison of DNI to "Pass" provides insight into the burn behavior and how the fabrics are passing part 1610, which is lost in the other analyses, as the non-numeric DNI results are excluded.

Table 5) shows the Pass, DNI, and Global Pass results with the current laundering procedure, as compared to the two alternative laundering options (LP1 and Agit), in addition to the current dry cleaning procedure, compared to the three alternative dry cleaning options (HydroC, Silico, and Bu).

ĺ	a) 2X2 Tabl LP1	le of (Curren	it to	b) 2X2 Tab Agit	le of (Currer	nt to						
	CurrState	DNI	Pass	Total	CurrState	DNI	Pass	Total						
	DNI	53	23	76	DNI	39	37	76						
	Pass	41	63	104	Pass	15	89	104						
	Total	94	86	180	Total	54	126	180						
C H	c) 2X2 Tabl HydroC	le of (Curren	t to	d) 2X2 Tab Silico	le of (Currer	nt to	e E	e) 2X2 Tab 3U	le of	Curre	nt to	
C H	c) 2X2 Tabl HydroC CurrState	le of (DNI	Curren Pass	t to Total	d) 2X2 Tab Silico CurrState	le of (Currer Pass	nt to Total	E	e) 2X2 Tab 3U CurrState	le of	Curre Pass	nt to Total	
ł	c) 2X2 Tabl HydroC CurrState DNI	DNI 51	Curren Pass 25	t to Total 76	d) 2X2 Tab Silico CurrState DNI	Ie of ODNI	Currer Pass 32	nt to Total 76	E	e) 2X2 Tab 3U CurrState DNI	DNI 43	Curre Pass 33	nt to Total 76	
c H	c) 2X2 Tabl HydroC CurrState DNI Pass	DNI 51 35	Pass 25 69	t to Total 76 104	d) 2X2 Tab Silico CurrState DNI Pass	le of 0 DNI 44 50	Pass 32 54	Total 76 104	E	e) 2X2 Tab 3U CurrState DNI Pass	DNI 43 22	Pass 33 82	nt to Total 76 104	
C H	c) 2X2 Tabl HydroC CurrState DNI Pass Total	DNI 51 35 86	Pass 25 69 94	t to Total 76 104 180	d) 2X2 Tab Silico CurrState DNI Pass Total	le of 0 DNI 44 50 94	Pass 32 54 86	Total 76 104 180	E	e) 2X2 Tab 3U CurrState DNI Pass Total	DNI 43 22 65	Pass 33 82 115	nt to Total 76 104 180	

Tables 5 a-e) Tabulation of Global Pass and DNI for All Plain Surface Fabrics when compared to the Current Procedure (note: all plain surface fabrics were either DNI or Pass with no failures)

The most notable takeaway from Table 5) is that the Global Pass results (*i.e.*, Pass and DNI results, combined) are 100 percent consistent for each alternative laundering and dry cleaning procedure, when compared to each of the alternative procedure options. In other words, for all of the plain surface fabric specimen tested, the flammability classifications are the same (*i.e.*, permissible for use in clothing) when using the alternative laundering and dry cleaning options, as they are for the current procedures in the standard. This indicates that the flammability results under each of the options staff assessed are consistent with the results under the current standard, suggesting that any of the alternative options would provide acceptably comparable results.

Table 5) also shows comparisons between DNI and Pass results for each alternative procedure, as compared to the current standard. For example, Table 5a) shows the results for the current laundering procedure, as compared to the LP1 laundering procedure. Considering the concordance and discordance of these results can be informative. In this context, concordance refers to results where both procedures yielded DNI results, or both procedures yielded Pass results. In Table 5a), there are 116 concordant results (53 concordant DNI results and 63 concordant Pass results). Discordance refers to results where the fabric yielded different DNI or Pass results, depending on the procedure used. For Table 5a), there are 64 (23 + 41) discordant results, compared to the current laundering procedure and the LP1 procedure. Table 5b), which compares the current laundering procedure and the Agit procedure, shows similar

comparability to the current standard, with 128 concordant results and 52 discordant results. However, these results are not statistically significant, so there is no detectable difference in the laundering or dry cleaning procedures. In general, when there are more concordant results than discordant results, the procedures are more similar, and lower discordance numbers generally indicate the similarity of procedures. Although concordant and discordant results are informative, it is expected that there will be variation in DNI and Pass results for multiple specimens, even though they are of the same fabric that underwent the same refurbishing procedure, and individual fabric results (later in this memorandum) indicate that different fabrics yielded slightly greater concordance with a particular alternative method than other fabrics. Overall, the key indicator of the similarity or comparability of test procedures is the Global Pass results since these are the basis for classifications in the standard.

Figures 1a-b) provides a graphical illustration of the burn time (denoted as time to event) for all of the plain surface fabrics tested. The vertical axis indicates the percent of fabrics associated with the burn time from 0 to 10 seconds for the laundering procedures and 0 to 15 seconds for the dry cleaning procedures and the horizontal axis shows the burn time, in seconds. Specifically, Figure 1 illustrates that approximately 60 percent of all laundered fabrics have a burn time of 5 seconds. Furthermore, as Figure 1 shows, the burn times for all of the laundering methods are tightly clustered from approximately 5 to 8 seconds for the laundering procedures and 6 to 9 seconds for the dry cleaning procedure. This indicates that both the laundering and dry cleaning procedures yield largely similar burn time results. In addition, Figure 1 shows that all of the burn times, for each set of laundering procedure options and dry cleaning procedure options, are well above the 3.5 second threshold for Class 1, indicating that all of the options yielded completely consistent classification results with the current standard. Also, Figure 1 shows that the majority of burn times fall between 5 seconds and 8 seconds, which is well above the 3.5 second threshold in the standard, indicating that slight variability in results under these alternative methods would be unlikely to change the overall classification, as compared to the current standard.



Figure 1a-b) Global Time to Event for Plain Surface Fabric Global Burn Time Stratified by Laundering or Dry Cleaning Procedure

Figures 2a-b) provides boxplots of burn times for the potential laundering and dry cleaning procedures. The line at 3.5 seconds delineates the threshold in the standard for classifying a fabric as permissible for use in clothing (Class 1). Like Figure 1, Figure 2 shows that the burn times for all of the laundering methods and dry cleaning methods yield largely similar burn time results. Similar to the time to event curve and means provided in Figure 1 and Table 4, respectively, this supports the comparability of the burn times across the tested procedures and suggests that LP1 or Agit would be suitable for replacing the laundering procedure in the standard, and it suggests further that HydroC, Silicon, or BU are suitable alternatives for the current 1610 procedure using perchloroethylene.



Figures 2 a-b) Boxplot of Ignition Time for All Plain Surface Fabrics Stratified by Laundering or Dry Cleaning Procedures

The previous tables and figures examine all burn times of plain surface fabric; however, it is of interest to determine if the patterns observed for the combined fabric and refurbishing procedure burn times are similar for the six specific plain surface fabrics (Fabrics A-F) for each of the 30 replicates tested. Results for each plain surface fabric are presented below. -The same descriptive statistics that are presented above are presented for each plain surface fabric type—*i.e.*, (1) overall mean, n-the number of specimen that had burn times, standard deviation, and range (min, max); (2) the concordance/discordance of observed outcome (Pass/DNI); (3) the time to event survival curves; and (4) the graphical representation of the descriptive statistics: boxplots.

Fabric A

There were 30 specimens of Fabric A that underwent the flammability testing procedure in part 1610 to identify the burn time for the laundering and the dry cleaning procedures under consideration. Table 6a) and Table 6b) provide the mean, standard deviation, and range of burn times for all specimen that ignited (*i.e.*, excludes DNI).

Variable	N	Mean	Std Dev	Minimum	Maximum
CURRENT	26	6.75	0.50	5.90	7.90
LP1	18	7.12	0.27	6.80	7.70
AGIT	24	6.69	0.27	6.20	7.30

Table 6a) Descriptive Statistics of Burn Time (in seconds) for Fabric A Laundering Procedures

Table 6b) Descriptive Statistics of Burn Time (in seconds) for Fabric A Dry Cleaning Procedures

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	26	6.75	0.50	5.90	7.90
HYDROC	16	6.83	0.37	6.20	7.60
SILICO	4	6.85	0.50	6.30	7.50
BU	27	6.31	0.30	5.70	6.80

Within these tables of the descriptive statistics, the average burn time for all laundering and dry cleaning procedures had similar means and ranges. It should be noted that there were as few as four burn times recorded for the Silico Dry Cleaning procedure, while the current 1610 procedure had 26 observed burn times, and the BU dry cleaning procedure had 27 specimens with a burn time.

Table 7 presents the DNI and Pass results separately for Fabric A, with Table 7a-b), providing laundering procedure results and Table 7c-e), providing dry cleaning procedure results.

a) LP1						b) Agit										
LP1	Curr				Ag	git Current										
	DNI	Pa	ass 1	Fotal			D		Ра	ass	Tota	I				
DNI	1	11	1	12		DN	DNI 0		6		6					
Pass	3	15	5 1	18		Pass		4	20)	24					
Total	4	26	; 3	30		Total 4		4	26	26 30						
c) HydroC			7	d) Silico								e) BL	J			
Current				LP1 Current					LP1	Curre	ent					
пуагос	D		Pass	Total				DN	11	Pass	To	tal		DNI	Pass	Total
DNI	3	,	11	14		D	DNI		4 2		26		DNI	0	3	3
Pass	1	,	15	16		Ρ	Pass			4	4		Pass	4	23	27
Total	4		26	30		Т	otal	4		26	30		Total	4	26	30

Tables 7a-e) Fabric A Comparison of Pass vs. DNI for the Laundering and Dry Cleaning Procedures

Comparing the concordant and discordant results in Table 7 suggests that the silicon solvent option may be slightly less comparable to the current standard, since its concordance with the current standard is slightly lower and its discordance is slightly higher, particularly in comparison to the HydroC and BU options.

Figure 3a) illustrates the burn time, if applicable, for the laundering procedures of LP1 and Agit for Fabric A. Within the graph, there is significant overlap between all three laundering procedures, which suggests that the burn times for LP1 and Agit are comparable to the current 1610 procedure.



Figure 3a) Fabric A Burn Time for Laundering Procedures

Figure 3b) illustrates the burn time for the dry cleaning procedures of HydroC, Silico, and BU, as well as the current 1610 procedure. Considering the graphical results, the burn times of the three different dry cleaning procedures are comparable to the current procedure.



Figure 3b) Fabric A Burn Time for Dry Cleaning Procedures

The graphical results of the boxplots, which illustrate the mean, median, mode, and 25th and 75th percentiles, are provided in Figure 4a) and Figure 4b) for the laundering procedure and dry cleaning procedure, respectively, for Fabric A.



Figures 4a and b) Boxplot of Burn Time for Fabric A Laundering and Dry Cleaning Procedures

Both graphs for the laundering and dry cleaning procedures demonstrate that all specimens had a burn time of 3.5 seconds or more. Furthermore, the boxplots for the Fabric A specimen have overlap when considering the 25th and 75th quartile and the median burn time.

To summarize, because Fabric A is a plain surface fabric, under the standard, a burn time of 3.5 seconds or more results in the fabric being Class 1, as does a DNI result (unless additional specimen of the fabric yields non-DNI results, in which case, those specimens will determine the classification). Using those criteria, all of the options for alternate laundering and dry cleaning procedures yielded flammability results that are 100 percent consistent with the current standard for Fabric A.

Fabric B

There were 30 specimens of Fabric B that underwent the flammability testing procedure in part 1610 to identify the burn time for the laundering and dry cleaning refurbishment procedures. Table 8a) and Table 8b) provide the mean, standard deviation, and range of burn times.

Variable	Ν	Mean	Std Dev	Minimum	Maximum
Current	16	6.49	0.26	6.00	7.00
LP1	22	6.38	0.32	5.80	7.10
Agit	28	6.43	0.32	5.60	7.10

 Table 8a) Descriptive Statistics of Burn Time (in seconds) for Fabric B Laundering Procedures

Table 8b) Descriptive Statistics of Burn Time (in seconds) for Fabric B Dry Cleaning Procedures

Variable	N	Mean	Std Dev	Minimum	Maximum
CURRENT	16	6.49	0.26	6.00	7.00
HYDROC	9	6.53	0.35	6.10	7.00
SILICO	6	7.52	0.26	7.10	7.90
BU	7	7.29	0.43	6.70	7.90

Within these tables of the descriptive statistics, you can see that the average burn time for all laundering and dry cleaning procedures had similar means and ranges. It should be noted that there were as few as six burn times recorded for the Silico dry cleaning procedure, while the current 16 CFR part 1610 procedure had 16 observed burn times, and the Agit laundering procedure had 28 specimens that had noted burn times.

Table 9 presents the DNI and Pass results separately for Fabric B, with Table 9a) providing laundering procedure results and Table 9b) providing dry cleaning procedure results.

a)) LP1							b) .	Agit									
LP1	Current						Ag	git	Current									
	DI	NIF	Pass	T	otal			DN NI 1		Pa	ass	Т	otal					
DNI	2	6	6	8		I	DN		1 1 s 13 1			2						
Pass	12	2	10	22	2		Pas	ss 13 15		5	28	3						
Total	14	۱	16	3(C	-	Tot	tal	14		6	30						
c) HydroC			7	d) Silico							1	e)	BU					
Current					Silico	Current							Current					
Tiyuro		DNI	Pas	SS	Total		Silic		D	NI	Pa	SS	Total			DNI	Pass	Total
DNI		10	11		21		[DNI 1		2	12		24		DNI	12	11	23
Pass		4	5		9		F	Pass	2		4		6		Pass	2	5	7
Total		14	16		30		٦	Tota	14	1	16		30		Total	14	16	30

Tables 9a-e) Fabric B Comparison of Pass vs. DNI for the Laundering Procedures

Considering the tabular values in 9a -e) There is similar concordance and discordance when examining both the laundering and dry cleaning procedures.

Figure 5a) illustrates the burn time, if applicable, for the laundering procedures of LP1 and Agit. Within the graph, there is significant overlap among all three laundering procedures, which suggests that the burn times for LP1 and Agit are comparable to the current 16 CFR part 1610 procedure.



Figure 3a) Fabric B Burn Time for Laundering Procedures

Figure 5b) illustrates the burn time for the dry cleaning procedures of HydroC, Silico, and BU and the current 16 CFR part 1610 procedure. Considering the graphical results, the burn time of the three different dry cleaning procedures are comparable to the current procedure.



Figure 5b) Fabric B Burn Time for Dry Cleaning Procedures

The graphical results of the boxplots, which illustrate the mean, median, mode, and 25th and 75th percentiles, are provided in Figure 6 a and b) for the laundering procedure and dry cleaning procedure, respectively.


Figure 6a-b) Boxplot of Burn Time for Fabric B Laundering and Dry Cleaning Procedures

Both graphs for the laundering and dry cleaning procedures demonstrate that all specimens had a burn time of 3.5 seconds or more. Furthermore, the boxplots for the Fabric B specimen have overlap when considering the 25th and 75th quartile, as well as the median burn time.

To summarize, because Fabric B is a plain surface fabric, under the standard, a burn time of 3.5 seconds or more results in the fabric being Class 1, as does a DNI result (unless additional specimen of the fabric yields non-DNI results, in which case those specimens will determine the classification). Using those criteria, all of the options for alternate laundering and dry cleaning procedures yielded flammability results that are 100 percent consistent with the current standard for Fabric B.

Fabric C

There were 30 specimens of Fabric C that underwent the flammability test procedure in part 1610 to identify the burn time for the laundering and the dry cleaning refurbishment procedures. Tables 10a) and b) provide the mean, standard deviation, and range of burn times.

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	28	5.24	0.38	4.70	6.10
LP1	29	5.12	0.35	4.60	6.00
AGIT	30	5.30	0.34	4.80	6.20

 Table 10a)
 Descriptive Statistics of Burn Time (in seconds) for Fabric C Laundering Procedures

Table 10b) Descriptive Statistics of Burn Time (in seconds) for Fabric C Dry Cleaning Procedures

Variable	N	Mean	Std Dev	Minimum	Maximum
CURRENT	28	5.24	0.38	4.70	6.10
HYDROC	29	5.28	0.32	4.90	6.60
SILICO	29	5.25	0.27	4.80	5.90
BU	3	5.38	0.34	4.90	6.60

Within these tables of the descriptive statistics we can see that the average burn time for all laundering and dry cleaning procedures had similar means and ranges. It should be noted that nearly all 30 specimens had burn times for both the laundering and dry cleaning procedures. Additionally, the burn times were comparable for all procedures, with noted differences less than 0.15 seconds.

Table 11 presents the DNI and Pass results separately for Fabric C, with Table 11a) and b) providing laundering procedure results and Table 11c), d), and e) providing dry cleaning procedure results.

a)	LF	P1							b)	A	git									
LP1	С	urrer	nt					4	Agit	С	urre	ent								
	D	NI	Pa	ass	Т	otal				DI	NI	Pa	ass	Тс	otal					
DNI	0		1		1			D	NI	0		0		0						
Pass	2		27	7	29	9		Ρ	ass	2		28	}	30)					
Total	12	2	12	28	30)		Т	otal	2		28	3	30)					
c)	Η	ydro	С							d)	Si	lico					a)	LP1		
Hydro	C	Cur	re	ent					Silic	20	Сι	urre	ent				LP1	Curre	ent	
Tiyuro		DN	I	Pas	s	Tota	al		Onic	.0	DI	NI	Pas	SS	Tota	al		DNI	Pass	Total
DNI		0		1		1			DN	I	0		1		1		DNI	0	0	0
Pass		2		27		29			Pas	s	2		27		29		Pass	2	28	30
Total		2		28		30			Tota	al	2		28		30		Total	2	28	30

Tables 11a-e) Fabric C Comparison of Pass vs. DNI for the Laundering Procedures

Figure 7a) illustrates the burn time, if applicable, for the laundering procedures of LP1 and Agit. Within the graph, there is significant overlap among all three laundering procedures, which suggests that the burn times for LP1 and Agit are both comparable to the current 16 CFR part 1610 procedure.



Figure 7a) Fabric C Burn Time for Laundering Procedures

Figure 7b) illustrates the burn time for the dry cleaning procedures of HydroC, Silico, and BU and the current 16 CFR part 1610 procedure. Considering the graphical results, the burn times of the three different dry cleaning procedures are comparable to the current procedure.



Figure 7b) Fabric C Burn Time for Dry Cleaning Procedures

The graphical results of the boxplots, which illustrate the mean, median, mode, and 25th and 75th percentiles, are provided in Figure 8a and Figure 8b) for the laundering procedure and dry cleaning procedure, respectively.



Figure 8a-b) Boxplot of Burn Time for Fabric C Laundering and Dry Cleaning Procedure Procedures

Both graphs for the laundering and dry cleaning procedures demonstrate that all specimens had burn times of 3.5 seconds or more. Furthermore, the boxplots for the Fabric C specimen have overlap when considering the 25th and 75th quartile, as well as the median burn time.

To summarize, because Fabric C is a plain surface fabric, under the standard, a burn time of 3.5 seconds or more results in the fabric being Class 1, as does a DNI result (unless additional specimen of the fabric yields non-DNI results, in which case those specimens will determine the classification). Using those criteria, all of the options for alternate laundering and dry cleaning procedures yielded flammability results that are 100 percent consistent with the current standard for Fabric C.

Fabric D

There were 30 specimens of Fabric D that underwent the flammability testing procedure in 16 CFR part 1610 to identify the burn time for both the laundering and the dry cleaning refurbishment procedures. Table 12a) and b) provide the mean, standard deviation, and range of burn times.

Table 12a) Descriptive Statistics of Burn Time (in seconds) for Fabric D Laundering Procedures

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	24	6.03	0.41	5.20	7.50
LP1	12	5.98	0.41	5.60	7.10
AGIT	26	6.16	0.36	5.60	7.10

Table 12b) Descriptive Statistics of Burn Time (in seconds) for Fabric D Dry Cleaning Procedures

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	24	6.03	0.41	5.20	7.50
HYDROC	27	5.62	0.28	4.90	6.20
SILICO	23	6.13	0.44	5.40	6.80
BU	27	5.54	0.40	4.80	6.20

Within these tables of the descriptive statistics, the average burn time for all specimen D fabrics, considering laundering and dry cleaning procedures, had similar means andranges. It should be noted that there were as few as 12 burn times recorded for the LP1 laundering procedure, while the current 16 CFR part 1610 procedure had 24 observed burn times.

Table 13 presents the DNI and Pass results separately for Fabric A, with Table 13a) and b) providing laundering procedure results, and Table 13c), d), and e) providing dry cleaning procedure results.

a)	LI	P1							b)	A	git									
LP1	С	urre	ent					A	Agit	Сι	urre	ent								
	D	NI	Р	ass	Т	otal				DI	NI	Pa	ass	Т	otal					
DNI	5		1:	3	18	8		D	NI	1		3		4						
Pass	1		1	1	1:	2		Ρ	ass	5		21		26	3					
Total	6		24	4	3	0		Т	otal	6		24	ŀ	30)					
c)	Н	ydro	oC	,						d)	Sil	lico					e)	BU		
Hydro	c	Cu	irre	ent					Silic	20	Сι	urre	ent				BU	Curre	ent	
Tiyuro		DN	11	Pas	S	Tota	al		Onic	.0	D	NI	Pas	SS	Tota	al		DNI	Pass	Total
DNI		0		3		3			DNI		0		7		7		DNI	0	3	3
Pass		6		21		27			Pas	S	6		17		23		Pass	6	21	27
Total		6		24		30			Tota	al	6		24		30		Total	6	24	30

Tables 13a-e) Fabric D Comparison of Pass vs. DNI for the Laundering Procedures

Figure 9 a-b) illustrates the burn time (time to event) for laundering and dry cleaning refurbishment procedures for Fabric D. Figure 9a) illustrates the burn time, if applicable, for the laundering procedures of LP1 and Agit. Within the graph, there is significant overlap among all three laundering procedures, which suggests that the burn times for LP1 and Agit are comparable to the current 16 CFR part 1610 procedure.





Figure 9b) illustrates the burn time for the dry cleaning procedures of HydroC, Silico, and BU ang the current 16 CFR part 1610 procedure. Considering the graphical results for the burn times, all three different dry cleaning procedures are comparable to the current procedure.



Figure 9b) Fabric D Burn Time for Dry Cleaning Procedures

The graphical results of the boxplots, which illustrate the mean, median, mode, and 25th and 75th percentiles, are provided in Figure 10 a-b) for the laundering procedure and dry cleaning procedure, respectively.



Figures 10a-b) Boxplot of Burn Time for Fabric D Laundering and Dry Cleaning Procedures

Both boxplots for the laundering and dry cleaning procedures demonstrate that all specimens had a burn time of 3.5 seconds or more. Furthermore, the boxplots for the Fabric D specimen have overlap when considering the 25th and 75th quartile and the median burn time.

To summarize, because Fabric D is a plain surface fabric, under the standard, a burn time of 3.5 seconds or more results in the fabric being Class 1, as does a DNI result (unless additional specimens of the fabric yield non-DNI results, in which case those specimens will determine the classification). Using those criteria, all of the options for alternate laundering and dry cleaning procedures yielded flammability results that are 100 percent consistent with the current standard for Fabric D.

Fabric E

There were 30 specimens of Fabric E that underwent the flammability test procedures in part 1610 to identify the burn time for the laundering and the dry cleaning refurbishment procedures. Table 14a) and b) provide the mean, standard deviation, and range of burn times.

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	4	7.03	0.72	6.60	8.10
LP1	4	7.75	1.20	6.80	9.50
AGIT	6	7.53	0.42	7.20	8.20

Table 14a) Descriptive Statistics of Burn Time (in seconds) for Fabric E Laundering Procedures

Table 14b) Descriptive Statistics of Burn Time (in seconds) for Fabric E Dry Cleaning Procedures

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	4	7.03	0.72	6.60	8.10
HYDROC	4	7.58	1.22	6.80	9.40
SILICO	3	7.23	0.32	7.00	7.60
BU	6	6.98	0.29	6.70	7.50

Within these tables of the descriptive statistics, we see that the average burn time for all laundering and dry cleaning procedures had similar means and ranges. However, for Fabric E, the majority of fabric specimen did not ignite. For the specimen that did ignite, the mean, standard deviation, and range were comparable for both of the potential laundering procedures, as compared to the current standard, as well as the potential dry cleaning procedures.

Table 15 presents the DNI and Pass results separately for Fabric E, with Table 15a) and 15b) providing laundering procedure results, and Table 15c-e) providing dry cleaning procedure results.

a) LP1								
LP1	Curre	ent						
	DNI	Pass	Total					
DNI	22	4	26					
Pass	4	0	4					
Total	26	4	30					

b) Agit							
Agit	Curre	ent					
	DNI	Pass	Total				
DNI	21	3	24				
Pass	5	1	6				
Total	26	4	30				

Tables 15a-e) Fabric E Comparison of Pass vs. DNI for the Laundering Procedures

c) H	c) HydroC							
HydroC	Current							
Tiyaloo	DNI	Pass	Total					
DNI	22	4	26					
Pass	4	0	4					
Total	26	4	30					

d) Silico								
Silico	Current							
	DNI	Pass	Total					
DNI	23	4	27					
Pass	3	0	3					
Total	26	4	30					

e)	ΒU		
BU	Current		
	DNI	Pass	Total
DNI	21	3	24
Pass	5	1	6
Total	26	4	30

Figure 11a) illustrates the burn time, if applicable, for the laundering procedures of LP1 and Agit. Within the graph, there is significant overlap among all three laundering procedures for the limited burn time response time, which suggests that the burn times for LP1 and Agit are both comparable to the current 16 CFR part 1610 procedure.

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Figure 11a) Fabric E Burn Time for Laundering Procedures

Figure 11b) illustrates the burn time for the dry cleaning procedures of HydroC, Silico, and BU, as well as the current 16 CFR part 1610 procedure. The graphical results of the burn times of the three different dry cleaning procedures are comparable to the current procedure.



Figure 11b) Fabric E Burn Time for Dry Cleaning Procedures

The graphical results of the boxplots, which illustrate the mean, median, mode, and 25th and 75th percentiles, are provided in Figures 12a-b) for the laundering procedure and dry cleaning procedure, respectively.



Figures 12a-b) Boxplot of Burn Time for Fabric E Laundering and Dry Cleaning Procedures

Both graphs for the laundering and dry cleaning procedures demonstrate that all specimens had burn times of 3.5 seconds or more. Furthermore, the boxplots for the Fabric E specimen have overlap when considering the 25th and 75th quartile and the median burn time.

To summarize, because Fabric E is a plain surface fabric, under the standard, a burn time of 3.5 seconds or more results in the fabric being Class 1, as does a DNI result (unless additional specimen of the fabric yields non-DNI results, in which case those specimens will determine the classification). Using those criteria, all of the options for alternate laundering and dry cleaning procedures yielded flammability results that are 100 percent consistent with the current standard for Fabric E.

Fabric F

There were 30 specimens of Fabric F that underwent the flammability test procedures in part 1610 to identify the burn time for the laundering and the dry cleaning refurbishment procedures. Table 16a) and b) provide the mean, standard deviation, and range of burn times for Fabric F.

Variable Ν Mean Std Dev Minimum Maximum CURRENT 6 6.92 0.69 6.30 8.10 LP1 6.60 6.60 6.60 1 n/a AGIT 12 0.52 6.94 6.20 7.90

Table 16a) Descriptive Statistics of Burn Time (in seconds) for Fabric F Laundering Procedures

Table 16b) Descriptive Statistics of Burn Time (in seconds) for Fabric F Dry Cleaning Procedures

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	6	6.92	0.69	6.30	8.10
HYDROC	9	7.23	0.66	6.40	8.10
SILICO	21	6.73	0.72	5.50	8.90
BU	18	6.99	0.4	6.40	7.90

Within these tables of the descriptive statistics, it is of note that the burn times for the laundering procedure are limited, due to a significant number of specimens that did not ignite, particularly for the current laundering method, LP1 method, current dry cleaning method, and HydroC method. Thus, any comparisons of descriptive statistics, such as mean, standard deviation, and range should be considered with caution. However, it is also notable that the methods with the more frequent DNI results are the current methods, and they are the methods staff recommends proposing in the NPR.

Tables 17a-e) presents the DNI and Pass results separately for Fabric F, with Table 17a-b) providing laundering procedure results, and Table 17c-e) providing dry cleaning procedure results.

a) LP1			
LP1	Current		
	DNI	Pass	Total
DNI	23	6	29
Pass	1	0	1
Total	24	6	30

Table 17a-e) Fabric F Comparison of Pass vs. DNI for the Laundering and Dry Cleaning Procedures

b) Agit				
Agit	Current			
	DNI	Pass	Total	
DNI	16	2	18	
Pass	8	4	12	
Total	24	6	30	

c) HydroC				
HydroC	Current			
Tiyaroo	DNI	Pass	Total	
DNI	16	5	21	
Pass	8	1	9	
Total	24	6	30	

d) Silico				
Silico	Current			
Silico	DNI	Pass	Total	
DNI	5	4	9	
Pass	19	2	21	
Total	24	6	30	

e) BU			
BU	Current		
	DNI	Pass	Total
DNI	10	2	12
Pass	14	4	18
Total	24	6	30

Figure 13a) illustrates the burn time, if applicable, for the laundering procedures of LP1 and Agit. Within the graph, there is overlap among all three laundering procedures, which suggests that the burn times for both LP1 and Agit may be comparable to the current 16 CFR part 1610 procedure. However, similar to the mean burn time, it should be noted that there are very few data points collected, due to significant DNI.



Figure 13a) Fabric F Burn Time for Laundering Procedures

Figure 13b) illustrates the burn time for the dry cleaning procedures of HydroC, Silico, and BU as well as the current 16 CFR part 1610 procedure. The graphical results of Fabric F specimens' burn times of the three different dry cleaning procedures are comparable to the current procedure.



Figure 13b) Fabric F Burn Time for Dry Cleaning Procedures

The graphical results of the boxplots, which illustrate the mean, median, and spread, are provided in Figures 14a-b) for the laundering procedure and dry cleaning procedure, respectively.



Figures 14a-b) Boxplot of Burn Time for Fabric F Laundering and Dry Cleaning Procedures

Both graphs for the laundering and dry cleaning procedures demonstrate that all specimens had a burn time of 3.5 seconds or more, or they did not ignite. Furthermore, the boxplots for the Fabric F specimen have overlap when considering the 25th and 75th quartile, as well as the median burn time.

To summarize, because Fabric F is a plain surface fabric, under the standard, a burn time of 3.5 seconds or more results in the fabric being Class 1, as does a DNI result (unless additional specimens of the fabric yield non-DNI results, in which case those specimens will determine the

classification). Using those criteria, all of the options for alternate laundering and dry cleaning procedures yielded flammability results that are 100 percent consistent with the current standard for Fabric F.

RAISED FABRIC RESULTS

The results of burn time comparison of the laundering and dry cleaning procedures for all raised surface fabrics (Fabrics G-K) are presented and discussed below.

Tables 18a and 18b provide the mean burn time for all raised surface fabric specimen that ignited and had a burn time collected. This includes all specimens tested, because all of the raised fabric specimens tested had a burn time, with no missing values. Table 18a) provides the burn time information for the three laundering procedure options. For the laundering procedure comparisons, 150 specimens were tested for each option, with a mean burn time of 11.87 seconds for the current procedure, a mean burn time of 10.76 seconds for LP1, and a mean burn time of 10.86 seconds for Agit. These results indicate that the mean burn times for all three laundering procedures were very similar, suggesting that both LP1 and AGIT provide comparable burn times to the current standard.

However, it is also noteworthy that there was significant variability in burn times, depending on the fabric being tested, with a range of burn times between 2.00 seconds and 31.50 seconds. The overall variability of burn time results can be observed in both the pooled mean, standard deviation, and range presented in Table 18a-b).

Table 18 a)Descriptive Statistics of Burn Time (in seconds) Laundering Procedure for AllRaised Surface Fabrics

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	150	11.87	7.45	2.30	27.30
LP1	150	10.76	6.72	2.00	31.50
AGIT	150	10.86	6.55	2.20	24.90

Table 18b) provides the burn time information for the four dry cleaning procedure options. For the dry cleaning procedure comparisons, 150 specimens were tested for each option, with a mean burn time of 11.87 seconds for the current procedure, a mean burn time of 11.01 seconds for HydroC, a mean burn time of 10.57 seconds for Silico, and a mean burn time of 10.34 seconds for BU. These results indicate that the mean burn times for all three laundering procedures were very similar, suggesting that all three alternatives provide comparable burn times to the current standard.

There was significant variability in burn times, depending on the fabric being tested, with a range of burn times between 1.60 seconds and 32.70 seconds.

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	150	11.87	7.45	2.30	27.30
HYDROC	150	11.01	7.65	1.60	27.80
SILICO	150	10.57	7.08	1.90	32.70
BU	150	10.34	6.56	1.80	27.70

 Table 18b)
 Descriptive Statistics of Burn Time (in seconds)
 Dry Cleaning Procedure for All

 Raised Surface Fabrics
 Surface Fabrics
 Surface Fabrics

(*)Note as a reminder the comparator of interest is the current refurbishment procedure and the study data for the current procedure is the comparator to both the laundering and dry cleaning procedure

Raised fabric exposed to flammability testing yields four potential burn code characterizations: SFpoi, SFBBpoi, SFBBpoi,* and SFBB. The tables below, Table 19a-e), compare burn code characterizations for all combined raised surface fabrics for the laundering and dry cleaning procedures.

Table 19a) Comparison of Characterization of Burn Properties-LP1 vs Current

		LP1		Total
		SFBB	SFBBpoi	
Current	SFBB	0	3	3
	SFBBpoi	3	144	147
	Total	3	147	150

In Table 19a), the majority of characterizations (144 out of 150 fabric specimens) are identical. There are three specimens that are discordant with six specimens (3 for LP1 and 3 for Current) that are noted to have a discordancy of SFBBpoi and SFBB for each respective procedure.

Table 19b) Comparison of Characterization of Burn Properties-Agit vs Current

		Agit		Total
		SFBB	SFBBpoi	
Current	SFBB	2	1	3
	SFBBpoi	4	143	147

-				
	Total	6	144	150

In Table 19b), the majority of characterizations (143 out of 150 fabric specimens) are identical. There are two specimens that are concordant with both fabrics' characterization of SFBB. There is discordance with five specimens (4 for LP1 and 1 for Current) that are noted to have a discordancy of SFBBpoi and SFBB for the two procedures examined.

Raised Fabric

Table 19c) Comparison of Characterization of Burn Properties-HydroC vs Current

		HydroC			Total
		SFBB	SFBBpoi	SFBBpoi*	
Current	SFBB	0	3	0	3
	SFBBpoi	16	126	5	147
	Total	16	129	5	150

In Table 19c), the majority of characterizations (126 out of 150 fabric specimens) are identical, with both fabric specimens noted to be SFBB. There is discordance with 24 specimens that are noted to have a discordancy of SFBBpoi, SFBBpoi,* and SFBB for the two procedures: HydroC and current.

Table 19d) Comparison of Characterization of Burn Properties-Silico vs Current

		Silico			Total
		SFBB	SFBBpoi	SFBBpoi*	
Current	SFBB	0	3	0	3
	SFBBpoi	5	141	1	147
	Total	5	144	1	150

In Table 19d), the majority of characterizations (141 out of 150 fabric specimens) are identical with both fabric specimens noted to be SFBB. There is discordance with nine specimens that are noted to have a discordancy of SFBBpoi, SFBBpoi,* and SFBB for the two procedures: Silico and current.

Table 19e) Comparison of Characterization of Burn Properties-BU vs Current

		BU		Total
		SFBB	SFBBpoi	
Current	SFBB	0	3	3
	SFBBpoi	14	133	147

Total 14 136 150	-				
		Total	14	126	150
		TOLAI	14	130	150

In Table 19e), the majority of characterizations (133 out of 150 fabric specimens) are identical with both fabric specimens noted to be SFBB. There is discordance with 17 specimens that are noted to have a discordancy of SFBBpoi, SFBBpoi,* and SFBB for the two procedures: BU and current examined.

Figures 15a-b) provides a graphical illustration of the burn time (denoted as time to event) for all of the raised surface fabrics tested. The vertical axis indicates the percent of fabrics that experienced a burn time greater than the burn times in seconds based on the horizontal axis. As an example, this Figure demonstrates that approximately 40 percent of raised fabric specimens have burn times greater than 10 seconds. As Figure 15 shows, the burn times for all of the laundering methods are tightly clustered, indicating that they yield largely similar burn time results, and the same is true for dry cleaning procedures. In addition, Figure 15 illustrates the wide variability in burn times, depending on the fabric tested.



Figure 15a) All Raised Fabric Burn Times for Laundering Procedures



Figure 13b) All Raised Fabric Burn Times for Dry Cleaning Procedures

а) Laundering Proc	edures		k	b) Dry Cleaning Procedures
Ignition Time (in Seconds)				Ignition Time (in Seconds)	
	CURRENT	LP1	AGIT		CURRENT HYDROC SILICO BU

Figures 14a-b) Boxplot of All Raised Fabric Burn Times for Laundering and Dry Cleaning Procedures

Within the boxplots, there are two horizontal lines that denote the ignition burn times boundary, which is 4 seconds for the boundary between Class 3 and Class 2, and 7 seconds is the boundary between Class 1 and Class 2. Additional details related to the background and uses of these thresholds are described in Tab B: Memorandum of the Directorate of Laboratory Sciences, Division of Engineering, Burn Code Clarification.

Results for each raised surface fabric (Fabrics G-K) are presented below. Since there were no DNI results, the summary of each fabric will include the count, mean, standard deviation, and range of burn times. The analysis below also includes the time to event graphic, with boxplots to provide additional comparisons between the current 16 CFR part 1610 procedure and the alternative procedures.

Fabric G

Fabric G was a raised surface fabric that had a moderately long burn time, regardless of the refurbishment procedure used.

Tables 20a and 20b) provide the mean burn time for the raised surface fabric specimen: Fabric G. The current laundering procedure included 30 fabric specimens for the raised surface Fabric G, with a mean burn time of 19.66 seconds, and a standard deviation of 2.25 seconds. This can be compared to the LP1 results of the 30-fabric specimen, which had a mean burn time of 16.80 seconds, and a standard deviation of 2.13 seconds, and the 30 Agit specimens, with a mean burn time of 17.93 seconds, and a standard deviation of 2.3 seconds. Additional comparisons of the count, the mean, standard deviation, and range for all specimens of Fabric G can also be examined for the laundering procedures and the dry cleaning procedures.

Table 20a)Descriptive Statistics of Burn Time (in seconds) Laundering Procedure for RaisedSurface Fabric G

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	30	19.66	2.25	16.60	27.30
LP1	30	16.80	2.13	13.80	22.90
AGIT	30	17.93	2.30	10.10	22.50

Table 20b) provides the burn times, in seconds, for the current part 1610 dry cleaning procedure, as well as the alternative dry cleaning procedures: Silico, HydroC, and BU. The mean for the various proposed procedures varied from 13.72 seconds to 16.77 seconds, with standard deviations from 1.32 seconds to 2.55 seconds.

Table 20b) Descriptive Statistics of Burn Time (in seconds) Dry Cleaning Procedure for Raised Surface Fabric G

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	30	19.66	2.25	16.60	27.30
HYDROC	30	16.77	2.55	11.10	25.10
SILICO	30	15.91	1.32	13.60	19.20
BU	30	13.72	1.59	8.20	15.80

Within these tables of the descriptive statistics, it can be seen that the average burn time for all laundering and dry cleaning procedures was slightly faster for the alternative procedures. However, in all cases, the burn times led to passing the criteria for Class 1 for raised surface fabrics. As such, all of the options for alternate laundering and dry cleaning procedures yielded flammability results that are 100 percent consistent with the current standard for this fabric.

Regardless of the laundering refurbishment procedure (laundering: LP1, Agit or Dry Cleaning: HydroC, Silico, or BU), all fabric specimen and the current procedure for all G fabrics passed the pass/fail characterization, with all fabrics noted to be SFBBpoi.

The time to event curve in Figures 15a-b) provides a more detailed graphical representation of the burn time for both the laundering and dry cleaning procedures.



Figure 15a) Raised fabric Burn Time for Laundering Procedures Fabric G



Figure 15b) Raised Fabric Burn Time for Dry Cleaning Procedures Fabric G

The boxplot of burn times for the various laundering and dry cleaning procedures, shown in Figure 16, illustrates that the alternate procedures yield largely similar burn times to the current procedures, but with the alternate procedures having somewhat shorter burn times. Nevertheless, the difference in burn time is less than five seconds. The slightly reduced burn times under the alternate procedures for this fabric may suggest that the alternate procedures are more rigorous than the current procedures.



Figures 16a-b) Boxplot of Burn Times for Fabric G Laundering and Dry Cleaning Procedure

Fabric H

The Fabric H burn time was moderately long, with an average ignition time close to 20 seconds.

Tables 21a) and 21b) provide the mean burn time for the raised surface fabric specimen, Fabric H. Additional comparisons of the count, the mean, standard deviation, and range for all specimen of Fabric H can also be examined for the laundering procedures and the dry cleaning procedures.

Similar to Fabric G, the current laundering procedure in part 1610 had the longest burn time, compared to LP1 or Agit laundering procedures, but the mean burn times for all three options were similar.

Table 21a)Descriptive Statistics of Burn Time (in seconds) Laundering Procedure for RaisedSurface Fabric H

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	30	21.16	2.62	16.00	26.00
LP1	30	19.55	3.82	11.40	31.50
AGIT	30	18.54	2.90	10.90	24.90

Table 21b) provides the burn times, in seconds, for the current part 1610 dry cleaning procedure, as well as the alternative dry cleaning procedures: Silico, HydroC, and BU. All three alternative procedures had slightly faster burn times when compared to the current 1610 procedure. However, the mean burn times were largely similar for all four methods.

Table 21b)Descriptive Statistics of Burn time by Dry Cleaning Procedure for Raised SurfaceFabric H

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	30	21.16	2.62	16.00	26.00
HYDROC	30	22.25	3.10	13.30	27.80
SILICO	30	20.60	5.00	13.90	32.70
BU	30	20.76	2.83	15.00	27.70

Regardless of the laundering refurbishment procedure (laundering: LP1, Agit or Dry Cleaning: HydroC, Silico, or BU), all fabric specimen and the current procedure for all H fabrics passed the pass/fail characterization, with all fabrics noted to be SFBBpoi.

A visual representation of the burn time for Fabric H, in Figure 17a-b), illustrates that the burn times for all of the procedures were within a few seconds. It can be noted that the current 1610 procedure had a longer burn time, as the tabulations of the mean, standard deviation, and range indicated.



Figure 17a) All Raised Fabric Burn Time for Laundering Procedures Fabric H



Figure 17b) All Raised Fabric Burn Times for Dry Cleaning Procedures Fabric H

The boxplots in Figure 18 illustrate that the alternate procedures yield largely similar burn times as the current procedures.

a	a) Laundering Procedures		b) Dry Cleaning Procedures
Ignition Time (in Seconds)		e e le	
	CURRENT LP1 A	AGH	CURRENT HYDROC SILICO BU

Figures 18a-b) Boxplot of Burn Times for Fabric H Laundering and Dry Cleaning Procedures

Overall, the tabular and graphical representation of the burn time of the laundering and dry cleaning procedures for Fabric H illustrate that, in all cases, the burn times led to passing the criteria for Class 1 for raised surface fabrics. As such, all of the options for alternate laundering and dry cleaning procedures yielded flammability results that are 100 percent consistent with the current standard for this fabric.

Fabric I

Tables 22a and 22b) provide the mean burn times for the raised surface fabric specimen, Fabric I. Additional comparisons of the count, the mean, standard deviation, and range for all specimen of Fabric I can also be examined for both the laundering procedures, as well as the dry cleaning procedures.

For the laundering procedures, the Fabric I specimens had largely similar mean burn times, with somewhat wide variation, depending on the specimen, with ranges from 4.30 seconds to 12.7 seconds. The mean burn time for the current procedure was 7.18 seconds, with a standard deviation of 1.45 seconds, while the mean burn time was 6.31 seconds and 6.38 seconds for the LP1 and Agit procedures, respectively.

 Table 22a)
 Descriptive Statistics of Burn Times (in seconds) Laundering Procedure for Raised

 Surface Fabric I

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	30	7.18	1.45	5.00	12.70
LP1	30	6.31	1.03	4.30	9.10
AGIT	30	6.38	1.00	4.80	8.70

Table 22b) provides the burn times, in seconds, for the current part 1610 dry cleaning procedure, as well as the alternative dry cleaning procedures: Silico, HydroC, and BU. Again, the burn times were largely the same across procedures, with the tabular results of the mean, standard deviation, and range of the burn time for dry cleaning procedures being 5.91 seconds for the HydroC, 6.00 seconds for the Silico, 6.53 seconds for the BU dry cleaning procedures, compared with 7.18 seconds for the current procedure. In all cases, the current procedure had a slower burn time, on average, but this difference was less than 1 or 2 seconds.

 Table 22b)
 Descriptive Statistics of Burn Time (in seconds)
 Dry Cleaning Procedure for Raised

 Surface Fabric I
 Image: Surface Fabric

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	30	7.18	1.45	5.00	12.70
HYDROC	30	5.91	1.45	4.00	8.80
SILICO	30	6.00	1.13	4.30	10.10
BU	30	6.53	1.21	4.80	9.00

Fabric I had a variety of responses related to the acceptability of the various laundering procedures. The majority of I fabric specimens passed, having an observed burn pattern of SFBBpoi (LP1, Agit, Silico, and BU). However, the HydroC dry cleaning process had a variety
of burn pattern characterizations. Table 23 illustrates the observed burn patterns for HydroC and current refurbishing procedures.

		HydroC			Total
		SFBB	SFBBpoi	SFBBpoi*	
Current	SFBBpoi	8	17	5	30
	Total	8	17	5	30

Table 23) Comparison of Burn Pattern Characterization of Burn Properties-HydroC vs Current

Figures 19a and 19b) provide a different graphical representation of the burn time for both the laundering and dry cleaning procedures. As noted within the statistical tabulations, the current part 1610 processes yielded slightly longer burn times than the alternative laundering and dry cleaning procedures, but the time differential was within 1 or 2 seconds.



Figure 19a) All Raised Fabric Burn Times for Laundering Procedures Fabric I



Figure 19b) All Raised Fabric Burn Time for Dry Cleaning Procedures Fabric I

Figures 20a) and 20b) provide the boxplot of the laundering and dry cleaning procedures, respectively. There is significant overlap between the different laundering and dry cleaning procedures. As noted previously, the current 16 CFR part 1610 procedure had an overall longer burn time than other procedures.



Figures 20 a-b) Boxplot of Burn Times for Fabric I Laundering and Dry Cleaning Procedures

Overall, the tabular and graphical representations of the burn times of the laundering and dry cleaning procedures for Fabric I illustrate that small differences in burn time may be noted when comparing the new procedures to the current 16 CFR part 1610 procedure. However, the difference in burn time is less than 2 seconds and all specimens met the criteria for passing the flammability testing. As such, all of the options for alternate laundering and dry cleaning procedures yielded flammability results that are 100 percent consistent with the current standard for this fabric.

Fabric J

Fabric J, regardless of laundering or dry cleaning procedure, had a fast burn time with the average noted to be less than 3 seconds for all procedures. Table 23a) provides the mean burn

time for the current part 1610 laundering procedure, which is 2.84 seconds; and the LP1 and Agit burn times are 2.74 seconds and 2.89 seconds, respectively.

Table 23 a)Descriptive Statistics of Burn Time (in seconds) Laundering Procedure for RaisedSurface Fabric J

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	30	2.84	0.28	2.30	3.40
LP1	30	2.74	0.37	2.00	3.80
AGIT	30	2.89	0.34	2.20	3.50

Similar to the laundering procedures, it can be noted that in Table 19b), the mean time for the current 16 CFR part 1610 dry cleaning procedure is 2.84 seconds, and the comparator dry cleaning procedures' average burn times were: 2.23 seconds for HydroC, 2.60 seconds for Silico, and 2.48 seconds for BU.

As noted with other raised fabric, the current 1610 laundering procedure yielded slightly longer burn times than the alternative dry cleaning methods, but they were all very similar.

Table 23b) Descriptive Statistics of Burn Time (in seconds) Dry Cleaning Procedure for Raised Surface Fabric J

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	30	2.84	0.28	2.30	3.40
HYDROC	30	2.23	1.60	1.60	3.20
SILICO	30	2.60	1.90	1.90	4.20
BU	30	2.48	1.80	1.80	3.30

Fabric J had a variety of responses related to the acceptability of the various laundering procedures. All refurbishing procedures had concordances (agreement) and discordances (disagreement) in observed burn patterns.

Table 24a) illustrates the observed burn patterns for LP1 and current refurbishing procedures. As the Table illustrates, 24 fabric specimens have concordance in burn characterization: SFBBpoi. However, there are three fabric specimens that had discordancy with either SFBB and SFBBpoi, or SFBBpoi and SFBB, for LP1 and the current laundering procedure, respectively.

		LP1		Total
		SFBB	SFBBpoi	
Current	SFBB	0	3	3
	SFBBpoi	3	24	27
	Total	3	27	30

 Table 24a) Comparison of Burn Pattern Characterization of Burn Properties-LP1 vs Current

Table 24b) illustrates the observed burn patterns for Agit and current refurbishing procedures. As the chart illustrates, 23 fabric specimens have concordance in burn characterization: SFBBpoi and fabric specimen have concordance in burn characterizations: SFBB. However, there are three fabric specimens that had discordancy with either SFBB and SFBBpoi, or SFBBpoi and SFBB, for the Agit and the current laundering procedure, respectively.

Table 24b) Comparison of Burn Pattern Characterization of Burn Properties-Agit vs Current

		Agit		Total
		SFBB	SFBBpoi	
Current	SFBB	2	1	3
	SFBBpoi	4	23	27
	Total	6	24	30

Table 24c) illustrates the observed burn patterns for HydroC and current refurbishing procedures. The Table illustrates that 23 fabric specimens have concordance in burn characterization: SFBBpoi. However, there are three and eight fabric specimens that had discordancy with either SFBB and SFBBpoi, or SFBBpoi and SFBB, for the HydroC and the current laundering procedure, respectively.

Table 24c) Comparison of Burn Pattern Characterization of Burn Properties-HydroC vs Current

		HydroC		Total
		SFBB	SFBBpoi	
Current	SFBB	0	3	3
	SFBBpoi	8	19	27
	Total	8	22	30

Table 24d) illustrates the observed burn patterns for Silico and current refurbishing procedures. The Table shows that 21 fabric specimens have concordance in burn characterization: SFBBpoi, and fabric specimen have concordance in burn characterizations: SFBB. However, there are three fabric specimens that had discordancy with SFBB and SFBBpoi, or SFBBpoi and SFBB, or SFBB and SFBBpoi,* for the Silico and the current laundering procedure, respectively.

Table 24d) Comparison of Burn Pattern Characterization of Burn Properties-Silico vs Current

		Silico			Total
		SFBB	SFBBpoi	SFBBpoi*	
Current	SFBB	0	3	0	3
	SFBBpoi	5	21	1	27
	Total	5	24	1	30

Table 24e) illustrates the observed burn patterns for BU and current refurbishing procedures. Thirteen fabric specimens have concordance in burn characterization, SFBBpoi. However, there are three and 14 fabric specimens that had discordancy with either SFBB and SFBBpoi, or SFBBpoi and SFBB, for the BU and the current laundering procedure, respectively.

 Table 24e) Comparison of Burn Pattern Characterization of Burn Properties-BU vs Current

		BU		Total
		SFBB	SFBBpoi	
Current	SFBB	0	3	3
	SFBBpoi	14	13	27
	Total	14	16	30

The burn time graphics are provided in Figure 21a) and Figure 21b) for the laundering and dry cleaning procedures, respectively.

Figure 21a) shows that, for the laundering procedures, there is significant overlap in the burn times for all three procedures, current 16 CFR part 1610, LP1, and Agit.





Figure 21b) suggests that there may be slightly less overlap when comparing the dry cleaning procedures; however, the burn time differential is less than 1 second.





The boxplots in Figure 22 of the laundering and dry cleaning procedures demonstrate that both the LP1 and Agit procedures are comparable to the current standard, based on significant overlap of the burn time, and each dry cleaning process also has significant overlap in burn times.



Figure 22a-b) Boxplot of Burn Time for Fabric J Laundering and Dry Cleaning Procedures

Overall, the tabular and graphical representation of the burn times of the laundering and dry cleaning procedures for Fabric J illustrate that, in all cases, the burn times led to passing the criteria for Class 1 for raised surface fabrics. As such, all of the options for alternate laundering and dry cleaning procedures yielded flammability results that are 100 percent consistent with the current standard for this fabric.

Fabric K

Table 25a) provides the mean burn time for the current part 1610 laundering procedure of 8.51 seconds, and the mean burn time for the two alternate laundering procedures were 8.38

seconds and 8.58 seconds for LP1 and Agit, respectively. The range of burn times for the laundering procedure for Fabric K ranged from 7.10 seconds to 12.90 seconds. And similar standard deviations were noted for all procedures.

Table 25a) Descriptive Statistics of Burn Time (in seconds) Laundering Procedure for Raised Surface Fabric K

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	30	8.51	0.77	7.10	10.50
LP1	30	8.38	1.10	7.20	12.90
AGIT	30	8.58	0.81	7.40	11.20

Table 25b) provides the mean, standard deviation, and range of the current part 1610 and alternate dry cleaning procedures, HydroC, Silico, and BU. When considering the dry cleaning procedures, the mean burn time for the current part 1610 procedure was 8.51 seconds and the specimen exposed to HydroC had a burn time mean of 7.88 seconds; the Silico procedure had a mean burn time of 7.74 seconds; and the BU procedure had a mean burn time of 8.18 seconds. The standard deviations of these dry cleaning procedures also were similar.

Table 25b) Means of Burn time by Dry Cleaning Procedure for Raised Surface Fabric K

Variable	Ν	Mean	Std Dev	Minimum	Maximum
CURRENT	30	8.51	0.77	7.10	10.50
HYDROC	30	7.88	0.88	6.60	10.50
SILICO	30	7.74	0.69	6.50	9.40
BU	30	8.18	0.88	6.00	10.40

Regardless of the laundering refurbishment procedure (laundering: LP1, Agit, or Dry Cleaning: HydroC, Silico, or BU) all fabric specimens and the current procedure for all K fabrics passed the pass/fail characterization with all fabrics noted to be SFBBpoi.

The time to event curves, in Figure 23, provide an additional mechanism to examine and compare data. Figure 23a) shows that the burn time for all three laundering procedures are comparable with significant overlap.





Figure 23b) shows the burn time for all four dry cleaning procedures, indicating that current part 1610 procedure may yield slightly longer burn times than the other dry cleaning procedures of HydroC, Silico, and BU, but the difference is less than 2 seconds.





Figures 24a) and 24b) provide boxplots of the burn times for all Fabric K specimen. Examination of these plots demonstrates the comparability of the laundering and dry cleaning procedures with similar mean values and quantiles.



Figures 24a-b) Boxplot of Burn Time for Fabric K Laundering and Dry Cleaning Procedures

Overall, the tabular and graphical representation of the burn time of the laundering and dry cleaning procedures for Fabric K illustrate that, in all cases, the burn times led to passing the criteria for Class 1 for raised surface fabrics. As such, all of the options for alternate laundering and dry cleaning procedures yielded flammability results that are 100 percent consistent with the current standard for this fabric.

Summary

The results presented within this document demonstrate the comparability of potential alternate laundering and dry cleaning procedures to the current part 1610 refurbishment procedures. LP1 and Agit are options to replace the laundering procedures, while HydroC, Silico, and BU are all options for dry cleaning procedures. Staff's testing considered both plain and raised surface

fabrics when assessing these options, since both must undergo flammability testing and have different criteria for determining whether they may be used in clothing.

The results presented in this memorandum illustrate that the current part 1610 procedures are equivalent to the alternate laundering and dry cleaning procedures. In all cases, both the fabric specimens laundered or dry cleaned via the current part 1610 procedure, and specimens with the alternate laundering and dry cleaning procedures passed the threshold to be permissible for use in clothing, thereby yielding entirely consistent flammability results under the standard.

Conclusions

Based on the evidence provided within the fabric flammability study, both of the alternate laundering procedures (LP1 and Agit) and all three of the alternate dry cleaning procedures (HydroC, Silico, and BU) yield flammability results comparable to the current part 1610 refurbishment procedures.

Tab F: Memorandum of the Directorate of Economic Analysis

DATE: March 09, 2022

то:	Paige Witzen, Project Manager Division of Engineering, Directorate for Laboratory Sciences	DAT
THROUGH:	Alex Moscoso, Associate Executive Director, Directorate for Economic Analysis	
	Jose Tejeda, Division Director, Directorate for Economic Analysis	
FROM:	Cynthia Gillham, Economist, Directorate for Economic Analysis	
	David Olson, Economist, Directorate for Economic Analysis	
SUBJECT:	Regulatory Flexibility Act Analysis and Preliminary Regulatory Analysis for the Amendment to the Standard for the Flammability of Clothing Textiles	

This memorandum provides information required under the Flammable Fabrics Act (FFA; 15 U.S.C. §§ 1191-1204) and the Regulatory Flexibility Act (RFA; 5 U.S.C. §§ 601-612). The FFA requires the Commission to prepare a preliminary regulatory analysis for proposed rules, with specific content, including potential benefits and costs associated with the rule and potential alternatives (15 U.S.C. § 1193(i)). The RFA generally requires the Commission to prepare an initial regulatory flexibility analysis (IRFA) when issuing a proposed rule (5. U.S.C. § 603). However, an IRFA is not required when an agency certifies that, if the rule is promulgated, it would not have a "significant economic impact" on a "substantial number of small entities" (5 U.S.C. § 605(b)). When certifying, the agency must publish the certification with the NPR, along with information providing a "factual basis: for the certification. Accordingly, the Directorate for Economic Analysis (EC) drafted this memorandum to present a preliminary regulatory analysis and the factual basis for a certification for the draft proposed rule staff recommends for amendments to the Commission's Standard for the Flammability of Clothing Textiles, 16 CFR part 1610.

The recommended amendments to the Standard for the Flammability of Clothing Textiles, 16 CFR part 1610, would revise the standard's burn code descriptions, stop thread description, and refurbishing procedures for dry cleaning and laundering identified in the standard's test methods. The recommended revisions incorporate input from public comments submitted to the Commission in response to the agency's 2019 Request for Information (RFI) (84 Fed. Reg. 16797 Apr. 23, 2019), as well as information from CPSC staff's assessments and testing.

Draft Final Rule

Staff recommends amending the Standard for the Flammability of Clothing Textiles, hereafter referred to as "the Standard." The Standard includes requirements for testing fabrics that are intended to be used for clothing, to assess the flammability of the fabrics and determine whether they are suitable for use in clothing, as determined by classifications defined in the Standard. Testing laboratories use the Standard to determine that class 1 and 2 fabrics are permissible for use in clothing, while Class 3 fabrics are not.

The Standard was issued under the FFA, which authorizes the Commission to amend the Standard when necessary to protect the public against unreasonable risk of the occurrence of fire leading to death or personal injury, or significant property damage. Staff recommends several amendments to the Standard to improve clarity, streamline provisions, and reflect current industry practices and available equipment and materials for testing laboratories. These revisions would not alter substantively the flammability requirements or testing methods used, and they are intended to reduce burdens to testing laboratories and improve compliance, by ensuring the provisions in the Standard are understandable and can be met.

Burn Code Clarification (as described in Tab B)

The Standard includes test result codes (*i.e.*, burn codes) that help determine the classification of a tested fabric and whether it is permissible for use in clothing. CPSC staff recommends updating the description of the burn codes in the Standard to improve clarity of meaning and streamline the provisions. Staff recommends revisions to clarify the burn code provisions by adding information to the classification table and adding a note to the table to highlight that there is only one burn code used to determine if a fabric is Class 2 or 3. Also for clarification, staff recommends adding the name of each classification (normal flammability, intermediate flammability, and rapid and intense burning) to this table, and other clarifying text to the Standard. In addition, staff recommends revising the burn codes listed in section 1610.8 for raised surface fabrics to eliminate duplicative and unclear codes.

Stop Thread Specification (as described in Tab C)

The test apparatus required for flammability testing in the Standard includes as part of the necessary components stop thread, which is used to determine burn time. In the Standard, the stop thread is described as "a spool of No. 50, white, mercerized, 100% cotton sewing thread" (sections 1610.2(p), 1610.5(a)(2)(ii)). However, thread meeting this description has limited availability, the numbering is outdated, and the industry now largely uses the Tex system to

define thread size. To determine a suitable replacement description for the thread, staff conducted testing and reviewed other standards to refine the stop thread specification to align with threads available on the market and that yield comparable flammability results as the thread currently required in the Standard. Accordingly, staff recommends revising the Standard to specify that the stop thread consist of "3-ply, white, mercerized, 100% cotton sewing thread, with a Tex size of 35 to 45 Tex." This thread specification retains the primary elements of the current description, but it removes the outdated reference to "No. 50" and allows for a range of Tex sizes that are comparable to the current description.

Refurbishing Procedure (as described in Tab D)

The Standard requires that flammability testing be performed before and after refurbishing specimens, which includes dry cleaning and then laundering (*i.e.*, drying and washing) the specimens according to specific requirements. Staff recommends updating the dry cleaning solvent because the current dry cleaning solvent named in the Standard, perchloroethylene, is being increasingly restricted from use in some states. Staff also recommends updating the laundering procedure outlined in the Standard because the current procedure is out of date, and washing machines that meet the specifications of the procedure are no longer commercially available.

Dry cleaning. The Standard requires that the dry cleaning process use "perchloroethylene, commercial grade," as the dry cleaning solvent, and specifies parameters for this method (*e.g., drying time*). Although perchloroethylene is still used in the dry cleaning industry, in December 2020, the Environmental Protection Agency (EPA) issued a final risk evaluation for perchloroethylene and determined that there are unreasonable risks to workers, occupational non-users, consumers, and bystanders from use of perchloroethylene.¹ In June 2022, EPA released a draft revised risk determination for perchloroethylene. The draft revised risk determination finds that perchloroethylene presents an unreasonable risk of injury to human health under its conditions of use.² Furthermore, staff is aware that in California perchloroethylene will no longer be used in dry cleaning operations by January 1, 2023.³ Staff is

¹ https://www.epa.gov/chemicals-under-tsca/epa-releases-final-chemical-risk-evaluation-perchloroethylene.

² https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-evaluation-perchloroethylene.

³ https://ww2.arb.ca.gov/our-work/programs/phase-out-perchloroethlyene-dry-cleaning-process.

also aware that there is pending legislation in Minnesota to ban perchloroethylene before 2030.⁴ In Massachusetts, technical and financial support is available to dry cleaners to help them switch to a safer alternative.⁵

To accommodate the ongoing use of perchloroethylene within the industry with the increasing restrictions on its use, staff recommends adding an alternative solvent (and accompanying parameters) to the Standard. Staff tested solvents that are available on the market to identify an alternative that yields flammability results comparable to perchloroethylene. Based on the findings, staff recommends adding hydrocarbon solvent as an alternative, but staff requests comment on the alternatives available. Regardless, the addition of an alternative to perchloroethylene would not require testing laboratories to alter the solvent they use. Rather, it would provide an additional choice of solvent specified in the Standard for dry cleaning.

Laundering. The Standard requires that samples be laundered in washing and drying machines that meet certain conditions in accordance with American Association of Textile Chemists and Colorists (AATCC) Test Method (TM) 124-2006, Appearance of Fabrics After Repeated Home Laundering. However, washing machines that meet these conditions are no longer produced, while dryers continue to be available. As such, when CPSC's and testing laboratories' existing washing machines reach the end of their useful lives, and cannot be repaired, CPSC and other laboratories will be unable to test in accordance with the Standard.

Staff conducted testing to identify washing machines currently on the market that yield flammability results comparable to the current Standard. Based on staff's findings, staff recommends amending the Standard to replace reference to TM 124-2006 with reference to AATCC Laboratory Procedure 1, Home Laundering: Machine Washing (LP1 2021), Table I (1) Normal (IV) Hot for washing machines. Staff identified four laboratory-grade washing machines that have the functionality to perform test method LP1. Each of these machines is recommended by AATCC and can be used to test to a variety of AATCC-approved test methods.⁶

⁴ https://www.house.leg.state.mn.us/SessionDaily/Story/15700.

⁵ https://www.turi.org/Our Work/Industry Small Business/Small Businesses/Dry Cleaning

⁶ Manufacturers report that the washing machines meet the parameters listed in the current versions of AATCC. TM88B, TM88C, TM124, TM130, TM135, TM143, TM150, TM179, and TM207. These parameters are also listed in <u>AATCC LP1, Home Laundering: Machine Washing</u>, Table I. AATCC does not verify the parameters of washing machines or dryers. (https://aatcc.org/testing/).

Although this recommended change would remove the currently permissible washing machines from the Standard, testing laboratories that still have operable machines that comply with the current Standard could continue to use such machines under provisions already in section 1610.40. This section allows for the use of alternate apparatus or procedures other than those in the Standard, if the alternate is as stringent as, or more stringent than, the Standard. As the draft proposed rule explains, the test results provided in this briefing package could serve as the evidence supporting the equivalency of the current washing machines. If the Commission finds that the briefing package does not provide sufficient evidence to support equivalency, then the potential costs of the rule update may be non-trivial.

Staff also recommends replacing the reference to TM 124-2006 in the Standard as it applies to drying specifications, with reference to LP 1, Table VI, (Aiii) Permanent Press. The parameters for drying in LP1 almost entirely overlap with those in the current Standard, meaning that test labs would be unlikely to need to replace current drying machines. Moreover, referencing only a single standard (LP1) would make compliance easier for regulated entities. Furthermore, testing laboratories that have operable dryers that comply with the current Standard could continue to use such machines under provisions already in section 1610.40, as well.

Market Information

Testing laboratories that would be impacted by the recommended amendments to the rule are included within the classification NAICS sector 541380. Currently, there are more than 300 CPSC-accepted third party testing laboratories that test to the Standard for Children's product certification purposes.⁷ The majority of these third party testing labs are in Asia, mainly China. Approximately only one in 20 of these labs is in the United States. Outside of the Children's product certified laboratories, there are additional third party laboratories that conduct garment testing both inside and outside the United States. EC staff cannot offer a precise estimate of the number of these laboratories, but staff believes the number to be substantial. According to the Census Bureau, there are 7,389 testing laboratories in the United States. However, not all of these testing laboratories perform flammability testing and include laboratories as the theoretical lower and upper bound of potential laboratories affected. The number of laboratories affected by the rule is not reflected in the lower and upper bound but falls between them.

⁷ https://www.cpsc.gov/cgi-bin/labsearch/.

⁸ U.S. Census Bureau, 2020, County Business Patterns, Table ID: CB2000CBP.

Potential Benefits of the Recommended Amendments

The amendments staff recommends are equivalent in their effectiveness to the current performance tests in the Standard. However, the recommended amendments should improve compliance, by making it easier for test laboratories to comply with the Standard, and by providing a clear and up-to-date testing procedure that is easier to understand and use. The primary benefit of the recommended amendments would be burden reduction for testing laboratories. In addition, by improving compliance and the consistency of testing performed at testing laboratories, there could be some benefit to consumer safety, by ensuring more reliable and consistent flammability classifications, although such benefits would likely be small and difficult to measure. Given the nature of these benefits, and the difficulty of measuring any small improvements to consumer safety that might be derived from them, if there are any, staff will not provide quantified benefit estimates.

CPSC Laboratory Sciences (LS) staff were able to identify the following unquantified benefits for testing laboratories that test to the Standard resulting from the recommended updates.

Burn Codes. CPSC LS staff indicates in Tab B that updating the description of the burn codes would address uncertainty and enhance consistency in reporting results for 16 CFR part 1610. These recommended amendments would not alter testing, change the way classifications are determined, or affect flammability results. Therefore, staff expects the technical amendments to burn code classification would offer a small number of benefits, which are difficult to quantify. Staff recommends asking for comments on these benefits, including requesting data or other evidence as to their quantification.

Stop Thread. In Tab C, CPSC LS staff indicates that recommended changes would clear up confusion among testing laboratories over the current description of stop thread. Staff recommends revising the description of the stop thread to retain the primary elements of the current specification, while removing the outdated reference to "No. 50," effectively allowing testing laboratories to select from a range of Tex sizes that are comparable to the current specification. LS staff indicates that the proposed changes would make it easier for testing laboratories to source a thread that meets the specifications for 16 CFR part 1610. Therefore, staff expects this recommended amendment would offer a small amount of benefits, which are difficult to quantify. Staff recommends asking for comments on these benefits, including requesting data or other evidence as to their quantification.

Dry Cleaning Solvent. In Tab D, in a comparison study of dry cleaning and laundering methods, CPSC LS staff finds that, among testing laboratories, the hydrocarbon dry cleaning procedure is a suitable alternative to perchloroethylene, and further finds that it is comparable in cost to other

dry cleaning alternatives. Therefore, adoption of the hydrocarbon dry cleaning procedure as an alternative to perchloroethylene, while continuing to reference perchloroethylene as an acceptable dry cleaning solvent in the Standard, should make it easier for test laboratories to comply with the dry cleaning procedure when the use of perchloroethylene is restricted.

Another benefit associated with staff's recommended addition of the hydrocarbon solvent to the Standard is the potential reduction in the use of perchloroethylene and elimination of the health risks associated with it.⁹ While the use of perchloroethylene as a chemical solvent specified in the Standard's dry cleaning procedure will continue to be a potential risk to health because it is reasonably anticipated to be a human carcinogen,¹⁰¹¹⁽⁶⁾ the addition of the hydrocarbon alternative dry cleaning solvent to the Standard should allow for a reduction in the use of perchloroethylene.

Laundering. In Tab D, CPSC LS staff assesses LP1 (Table 1, Option 3) is already a standard used by testing laboratories. Therefore, adoption of LP1 should make it easier for testing laboratories to comply with the laundering procedure. This recommended amendment would ease burdens for testing labs because they have been unable to source compliant washing machines that are no longer commercially available. Staff expects that the recommended changes to the drying procedure would provide a relatively small amount of benefits, which are difficult to quantify because the benefits would largely consist of streamlining testing laboratories' need to obtain (in the case of new labs), maintain, and reference outside standards by referring only to one source (LP1) instead of two (LP1 and AATCC TM 124-2006) for the laundering specifications.

⁹ In December 2020, EPA issued a final risk evaluation for perchloroethylene, determining that there are unreasonable risks to workers, occupational non-users, consumers, and bystanders from 59 out of 61 conditions of use (www.epa.gov/chemicals-under-tsca/epa-releases-final-chemical-risk-evaluation-perchloroethylene).
¹⁰ According to PubChem, an open chemistry database at the National Institutes of Health, perchloroethylene (CAS No. 127-18-4) is mainly used as a cleaning solvent in dry cleaning and textile processing. Exposure to this substance irritates the upper respiratory tract and eyes and causes neurological effects, as well as kidney and liver damage. Perchloroethylene is reasonably anticipated to be a human carcinogen and may be linked to an increased risk of developing skin, colon, lung, esophageal, and urogenital tract cancer as well as lymphosarcoma and leukemia. (https://pubchem.ncbi.nlm.nih.gov/compound/31373)

¹¹Memorandum to Patty Adair, Project Manager, from Cassandra Prioleau, Ph.D., Directorate for Health Sciences, "Toxicity Review of Perchloroethylene." July 6, 2006.

Potential Costs of the Recommended Amendments

Burn Codes. The recommended amendments to the Standard related to burn code classification are technical in nature and pertain to written definitions found in the test procedure. The amendments would clarify existing definitions and may improve understanding of test procedures by testing laboratories that test to the Standard. These recommended amendments would not alter testing, change the way classifications are determined, or affect flammability results. Therefore, the technical amendments to burn code classification would have no significant impact on the costs of the flammability standards for clothing textiles.

Stop Thread. Similarly, the recommended amendments regarding stop thread would clarify the existing description, allow the continued use of the thread currently specified in the Standard, provide a wider range of available thread options to testing laboratories. In addition, it would not affect test results or flammability classifications. Therefore, this recommended amendment would have no significant impact on the costs of the flammability standard.

Dry-Cleaning Solvent. The amendments to the Standard related to the additional option for drycleaning with hydrocarbon solvent are not expected to increase costs to testing laboratories, because they effectively increase the number of approved options available to testing laboratories for testing to the Standard.¹²

Laundering. The amended laundering procedure staff recommends would provide the same effectiveness as the current laundering procedure.

The draft proposed rule explains that, under section 1610.40, firms may continue using washing machines that meet the current laundering procedure. If that is the case, firms have an option to continue using machines that comply with the current Standard, and this requirement is not expected to have a cost impact on testing laboratories.

Although the amended laundering procedure will have no cost impacts on testing laboratories, the following section presents information regarding the potential costs associated with upgrading existing machines to comply with the recommended laundering and dry cleaning procedures. In addition to the machine-related costs discussed in the following section, there may be a non-significant cost to obtain a copy of the LP1 standard estimated at \$70 or less per

¹² CPSC did not evaluate the additional hydrocarbon solvent option for health-related risks to laboratory workers. If such risks exist, it is possible they could be considered potential costs associated with the rule.

copy.¹³ However, many testing laboratories may already have a copy of LP1 (to comply with requirements outside the Standard); so this one-time cost would apply only to testing laboratories that do not already have LP1 and do not opt to use section 1610.40.

Discussion of the Potential Costs of Washers and Dryers

According to data collected by staff, laboratory-grade washing machines that are able to perform the laundering specifications in the recommended amendment to the Standard cost, on average, \$4,300, not including tax. Staff identified four washing machines that are able to perform the LP1 laundering specifications, as recommended in the draft proposed amended Standard (See Table 1). Typically, the total price of purchasing a machine includes the price of the unit, the cost of certified calibration, and packaging and shipping. Note that the price for shipping the washing machine varies, with representative examples listed below.

Washing Machine	Unit price	Calibration Certificate Cost	Packaging and Shipping
Machine 1	\$3,862	\$190	\$147 (packaging only)
Machine 2	\$3,060	\$150	\$570
Machine 3	\$3,600	\$320	\$780
Machine 4	\$3,700	\$350	\$430

Table 1. Prices of Laboratory Grade Washing Machines

Source: Quotes collected from suppliers in March 2022.

Although each of the four laboratory-grade washers can perform to the specifications of laundering procedure LP1, these machines cannot perform laundering according to the specifications of AATCC TM124-2006 (TM124-2006). Staff is currently unaware of any washing machine that can perform both the specified current (TM124-2006) and proposed (LP1) laundering procedure. Because of provisions in section 1610.40, labs would not be required to purchase washing machines that can perform laundering procedure LP1 if they still have machines that meet the current Standard. Because of this optionality, firms will incur a net cost. If a laboratory chooses to upgrade and purchase a washing machine listed in Table 1, this analysis assumes the laboratory expects to receive benefits from the upgrade that outweigh its acquisition costs. For example, laboratories may save money by purchasing a laboratory-grade

¹³ The list price for an electronic version of LP1 is \$70, while the cost the member price is \$50. Purchased standards are delivered as a link in the customer's emailed receipt (https://members.aatcc.org/store/lp001/2212/).

washing machine that can perform LP1 (\$4,300, not including tax)¹⁴ and avoiding the repair costs they would incur to maintain existing washing machine equipment.

Staff estimates the costs of maintaining and repairing old machines that are used for laundering procedure TM124-2006, the laundering procedure currently specified in the Standard, at \$300 annually. On average, staff estimates that each lab has 3 laboratory-grade washing machines that do not meet the recommended laundering procedure.

Staff also expects no costs associated with the recommended update to the dryer specification. Like washing machines, firms could continue to use dryers that comply with the current Standard under section 1610.40. Moreover, dryers that comply with LP1 largely also comply with the current Standard, which means that it is unlikely that testing laboratories will need to replace existing dryers under staff's recommended update.

Regulatory Alternatives

Staff considered several alternatives to the recommended revisions to the Standard. This section discusses potential costs and benefits associated with these alternatives, and it explains the reasons staff does not recommend them.

Burn Codes. Because the recommended amendments to the burn code provisions merely clarify existing requirements, the only other test result description alternative staff considered was to keep the current language in the Standard regarding the description of the burn codes. Regardless, staff recommends revising these provisions to clarify and streamline the codes.

Stop Thread. Staff considered variations on the recommended revision regarding stop thread. One potential regulatory alternative is to specify a single Tex size representing the thread staff currently uses under the Standard. However, this alternative could confine testing laboratories, by limiting the range of threads they may use for testing. Another potential regulatory alternative considered was to allow a wider range of Tex sizes. This alternative would provide testing laboratories greater flexibility to select from a range of test threads. Overall, staff's

¹⁴ The average total price of Machine 1 (3,862 + 190 + 147 = \$4,199), Machine 2 (3,060 + 150 + 570 = \$3,780), Machine 3 (3,600 + 320 + 780 = \$4,700), and Machine 4 (3,700 + 350 + 430 = \$4,480) machines is \$4,289.75, not including tax. Note that this estimate may underestimate the price for shipping for Machine 1.

recommended update imposes minimal costs, while offering testing laboratories greater flexibility and some small potential benefits.

Dry Cleaning Solvent. Staff considered three alternative dry cleaning solvents, in addition to perchloroethylene as a regulatory alternative to the current Standard which stipulates the use of perchloroethylene.¹⁵ Those alternative dry cleaning solvents are hydrocarbon, silicone, and butylal, The Toxic Use Reduction Institute (TURI) provides a financial comparison of alternatives in their assessment, including a summary of costs associated with each alternative in comparison to perchloroethylene. (See table 3.) Staff seeks comment on the alternatives presented and their associated costs.

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Methods	Equipment Costs	Solvent Costs
Perchloroethylene	\$40,000 to \$65,000	\$17
Hydrocarbon	\$38,000 to \$75,000	\$14 - \$17
Silicone	\$30,500 to \$55,000	\$22 - \$28
Butylal	\$50,000 to \$100,000	\$28 - \$34

Table 3. Dry Cleaning Methods – Financial Data

Source: TURI Assessment of Alternatives to Perchloroethylene

As Tab E explains, staff's testing found that the three alternatives considered, hydrocarbon, silicone, and butylal, yield flammability results comparable to the current Standard. As such, any or all of these alternatives may be potentially acceptable options as a replacement for (or an alternative to) perchloroethylene, if they do not pose any other unforeseen costs.

In addition, as a regulatory alternative, staff considered replacing perchloroethylene with hydrocarbon, specifically. This regulatory alternative would effectively restrict testing laboratories from using perchloroethylene and any other comparable dry cleaning alternative. In the conclusion of Tab D, LS staff recommends issuing an NPR to add a hydrocarbon dry cleaning procedure as an alternative option, while keeping the existing perchloroethylene dry cleaning procedure.

Laundering Procedure. Staff also considered several alternatives to the recommended update to the laundering procedures.

¹⁵ Staff did not consider removal of the dry cleaning step of the refurbishment procedure. The impact of a no drycleaning step alternative on comparable flammability remains unknown. With respect to washing machines, as described in Tab D and Tab E, staff assessed two revised laundering procedures when preparing the recommended proposed amendments to the Standard: (1) AATCC Laboratory Procedure 1 Table I, (1) Normal, (IV) Hot (LP1), and (2) AATCC 124-2006, with modifications to the laundering agitation speed (AGIT).

As a regulatory alternative to staff's recommendation to amend the Standard to reference LP1, the Commission could decide to adopt AGIT laundering procedure because it closely aligns with the current laundering procedure referenced in the Standard.¹⁶ (See Tab D and E.) However, the AGIT laundering procedure is not based on laundering methods developed by AATCC and is not used for other AATCC standards. In addition, staff notes that some testing laboratories already use LP1 for other testing. The laundering procedure LP1 is based on laundering methods and parameters originally developed as part of various AATCC standards.¹⁷

The cost of testing to the AGIT procedure might be more expensive comparatively because laboratory-grade washing machines are not sold pre-programmed to the AGIT specification settings, while they are sold pre-programmed with the LP1 setting.¹⁸ Using pre-programmed settings saves time and skilled labor resources during testing. It also reduces the chances of testing error in the lab. Therefore, the use of a not pre-programmed setting, AGIT, should be considered costlier in skilled-labor time and resources, as well as more cumbersome and a possible source of laboratory error, during testing. For these reasons, staff does not recommend the AGIT alternative.

Additionally, staff considered two approaches to maintain the cost neutrality of the recommended amendments to update the laundering procedure. Various proposals were considered to allow testing laboratories impacted by the rule update to continue using the washing machines they currently own to meet the provisions of the Standard:

(i) Require the use of LP1-compliant washing machines, but provide in the regulation, a phase-out period, during which washing machines that comply with AATCC TM124-2006 would also remain permissible.

¹⁷ AATCC LP1 is a complete laundering protocol that may be used in coordination with appearance evaluation, flammability preparation, or other laundering procedures. AATCC LP1 replaces AATCC M6.

¹⁸ The Machine 1 and Machine 2 laboratory-grade washing machines are sold pre-programmed for the LP1 setting.

¹⁶ The AGIT procedure reduces the required agitation speed from 179 spm to 120, keeping other parameters the same.

(ii) Add laundering method LP1 to the Standard, while keeping TM124-2006 as an additional laundering method option.

Either of these approaches would be cost neutral, or potentially cost-beneficial, because they would allow the continued use of the washing machines that are currently owned by testing laboratories and provide an alternative for when those machines are no longer usable. However, staff does not recommend these alternatives for several reasons.

For one, the purpose of this rule is to remove aspects of the Standard that are outdated, like washing machines that comply with TM124-2006.¹⁹ An additional issue with electing to phase out TM124-2006 over a period of time is that staff is currently not aware of an accurate or precise period that might be appropriate to allow for the replacement of existing laboratory-grade washing machines by testing laboratories that will need to upgrade their equipment. Staff cannot determine when a lab will need or wish to discontinue maintenance of their existing laboratory-grade washing machine and replace it with an updated machine.²⁰

For these reasons, staff recommends requiring the use of LP1-compliant washing machines in the Standard and relying on section 1610.40 to mitigate any costs associated with phasing out the use of functional washing machines that comply with the current Standard. However, if laboratories are required to provide additional proof of equivalence under section 1610.40, then this should be considered a burden to laboratories, and again, the two aforementioned approaches should be considered to reduce the costs associated with the draft proposed rule.

For dryers, staff considered retaining the current provisions in the Standard, which reference TM 124-2006, since dryers that meet this standard are still available on the market. This alternative would eliminate any costs associated with this recommended revision. However, the costs of the recommended change are already expected to be minimal since most dryers that meet the current Standard also meet LP1, and section 1610.40 would be an option for those that do not. As such, staff did not select this alternative.

¹⁹ Moreover, TM124-2006 should be removed from the Standard because it is more precisely a test method used to grade and evaluate the appearance of textile fabric after repeated home laundering, rather than a standard washing procedure. Meanwhile, LP1 is a standard washing procedure.

²⁰ In addition, CPSC's washing machine that complies with TM124-2006 is reaching the end of its useful life, at which point, staff will no longer be able to assess compliance for labs that use these machines. For a short period while these older machines remain in use under the allowance in section 1610.40, this may be acceptable; but in the long term, it does not make sense to allow something in the Standard that CPSC will not be able to assess.

Regulatory Flexibility Act Analysis

The RFA generally requires the Commission to prepare an IRFA, containing specific content, when issuing a proposed rule unless the agency certifies that, if the rule is promulgated, it would not have a "significant economic impact" on a "substantial number of small entities" (5 U.S.C. §§ 603, 605(b)). When certifying, the agency must publish the certification with the NPR, along with information providing a "factual basis" for the certification, and must provide the certification and supporting statement to the Office of Advocacy for the Small Business Administration. The Office of Advocacy for the Small Business Administration has provided guidance on the content necessary to provide a "factual basis" for a certification.²¹

The following analysis evaluates the potential economic impact on small entities, including small businesses, as required by the RFA.

Based on the analysis and conclusion that there are no significant cost impacts to any firms as a result of the recommended standard, staff concludes that there is support for the Commission to certify that this rule, if promulgated, will not have a significant impact on a substantial number of small entities, pursuant to 5 U.S.C. 605. Staff recommends seeking comments on this certification, including the threshold economic analysis and its underlying assumptions. The rest of this section discusses information relevant to the certification. According to small business size standards set by the Small Business Association (SBA), firms in NAICS sector 541380 (Testing Laboratories) would be considered small if the average annual receipts of a firm are less than \$16.5 million per year.²² According to this definition, roughly 70 percent of the CPSCaccepted testing laboratories located in the United States that test to the Standard would be considered small. According to 2020 data available from the Census Bureau, there are 7,389 testing laboratories in the United States.²³ If each of these labs tested to the Standard and approximately 70 percent of testing labs are considered small, then roughly 5,172 small testing labs could potentially be impacted. However, this estimate likely over-estimates the number of small firms affected, as not all testing labs in the United States test to the flammability standard. Using the small estimate of 300 CPSC-accepted third party test laboratories that test to the

²¹ A Guide for Government Agencies: How to Comply with the Regulatory Flexibility Act. U.S. Small Business Administration, Office of Advocacy (August 2017), available at: <u>https://advocacy.sba.gov/2017/08/31/a-guide-for-government-agencies-how-to-comply-with-the-regulatory-flexibility-act/</u>.
²² Table of size standards (sba.gov)

Standard, staff estimates 210 (70% of 300) CPSC-accepted third part testing labs that qualify as small firms.²⁴

In determining that the Commission could certify that this rule will not have a significant impact on a substantial number of small firms, staff used the following criteria. Staff determined that a reasonable threshold criteria for "significant economic impact" is cost in excess of 1 percent of the small firm's gross annual revenue. Staff also determined that a reasonable threshold for "substantial number" of entities impacted is 20 percent or more of the small domestic firms identified by staff.

As stated earlier in this memorandum, there are no costs to testing laboratories associated with the recommended updates to burn codes, stop thread, dry-cleaning or drying. This applies to small firms too. Among domestic CPSC-accepted testing laboratories that would be considered small according to SBA guidelines, the average total revenue among firms for which data were available was around \$3 million annually (\$2,930,192). One percent of annual average revenue would be approximately \$29,300 ($$2,930,192 \times 0.01 = $29,301.92$). The cost associated with this rule update is zero and therefore lower than the one percent threshold. This would also mean that less than 20 percent of small domestic would be impacted.

Conclusion

This memorandum provides the Commission with a discussion of the potential benefits and costs of the recommended amendments, required for a preliminary regulatory analysis, as well as the information needed to certify under the Regulatory Flexibility Act. Although the benefits of the recommended amendments are not quantified, staff was able to identify benefits to testing laboratories that test to the Standard resulting from the recommended updates.

Staff considered several regulatory alternatives to the recommended revisions and recommends requesting comment upon the assumptions as well as sources of uncertainty in the alternatives presented. Based on the information available, staff concludes that there is support for the Commission to certify that the rule, if promulgated, would not have a significant impact on a substantial number of small entities.