

U.S. Consumer Product Safety Commission



**REDUCED IGNITION PROPENSITY CIGARETTES:
IS THERE A CHANGE IN SMOLDERING IGNITION
HAZARD?***

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U.S. Consumer Product Safety Commission (CPSC)

- CPSC is an independent regulatory agency created “to protect the public against unreasonable risks of injury associated with consumer products.”¹ The CPSC’s work involves:
 - conducting research on emerging and potential product hazards;
 - developing voluntary consensus safety standards in cooperation with industry;
 - adopting and enforcing mandatory standards or banning consumer products if no feasible standard would adequately protect the public;
 - obtaining the recall of products; and
 - informing and educating consumers through the media, state and local governments, private organizations, and responding to consumer inquiries.

¹ Section 2(b)(1) of the Consumer Product Safety Act, 15 U.S.C. §2051(b)(1).



CPSC Authority and Cigarettes

- CPSC does not have statutory authority to regulate cigarettes, but it can regulate residential soft furnishings, which are often involved in cigarette-ignited fires.
 - Currently, the CPSC addresses the cigarette ignition risk for mattresses and mattress pads in the *Standard for the Flammability of Mattresses and Mattress Pads* (16 CFR part 1632).
 - The agency has proposed a standard for the flammability of upholstered furniture that addresses cigarette ignition risk (proposed 16 CFR part 1634).
- A cigarette is also used to evaluate the flammability of cellulosic insulation (16 CFR part 1209).



Introduction of RIP Cigarettes

- From 2004 to 2011, all states passed similar laws to require cigarettes to be of “lower” ignition strength, also known as “fire safe cigarettes” or reduced ignition propensity (RIP) cigarettes.
- In 2007, CPSC staff learned cigarette manufacturers were phasing out cigarettes that did not meet the state laws, effectively changing the cigarette market.



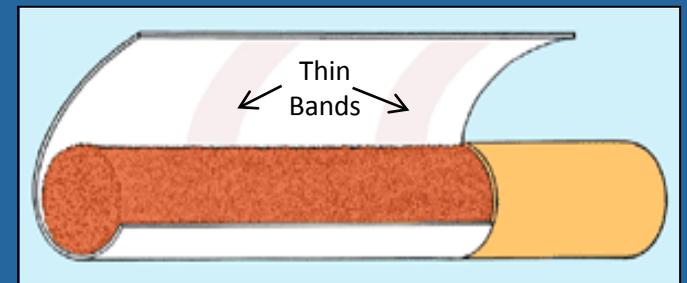
Project Motivation

- A reduced cigarette ignition hazard may warrant consideration of revisions to existing federal flammability regulations.
 - This may impact the direction of current proposed rulemakings.
- Do RIP cigarettes present a reduced ignition risk relative to conventional (non-RIP) cigarettes when placed on a mattress or mattress pad?



What Is a RIP Cigarette?

- A cigarette that is expected to self-extinguish when left alone.
- A cigarette that is required to be tested per ASTM E2187-04; a lit cigarette is placed on multiple layers of filter paper to observe if it will burn its full length.
- The RIP cigarette should produce a full length burn (FLB) no more than 10 of 40 times.
- Typically, the paper along the RIP tobacco column has two or three thin bands of less-porous paper.



Pictures: www.nfpa.org

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CPSC Task Outline

- Cigarette Packaging Selection
 - Packaging refers to the brand, style, and size, *e.g., Marlboro Lights 100's[®]*
- Material Property Characterization
- Phase I Tests: ASTM E2187-04
- Phase II Tests: Mattress and Mattress Pad Substrates



Cigarette Selection

Samples of RIP/non-RIP pairings of 13 cigarette packagings were collected for evaluation.

| Packaging | Filter | King size | Slim | Long | Regular | Light | Ultra-light | Menthol |
|-----------|--------|-----------|------|------|---------|-------|-------------|---------|
| CP1 | ✓ | | | | ✓ | | | |
| CP2 | ✓ | | | | ✓ | | | |
| CP3 | ✓ | | | ✓ | | | ✓ | |
| CP4 | ✓ | ✓ | | | | ✓ | | ✓ |
| CP5 | ✓ | | | | | ✓ | | |
| CP6 | ✓ | | | | ✓ | | | |
| CP7 | ✓ | ✓ | | | ✓ | | | ✓ |
| CP8 | ✓ | | | | | ✓ | | |
| CP9 | | | | | ✓ | | | |
| CP10 | ✓ | ✓ | | | | | ✓ | ✓ |
| CP11 | ✓ | | | | ✓ | | | ✓ |
| CP12 | ✓ | | ✓ | ✓ | | ✓ | | ✓ |
| CP13 | ✓ | ✓ | | | ✓ | | | |



Material Property Evaluations

- RIP and non-RIP cigarettes of each packaging were not significantly different:
 - tobacco column length and density did not vary;
 - burning temperature differences were not statistically significant; and
 - air permeabilities and citric acid levels in the cigarette paper were too variable within packagings to make comparisons between RIP and non-RIP.



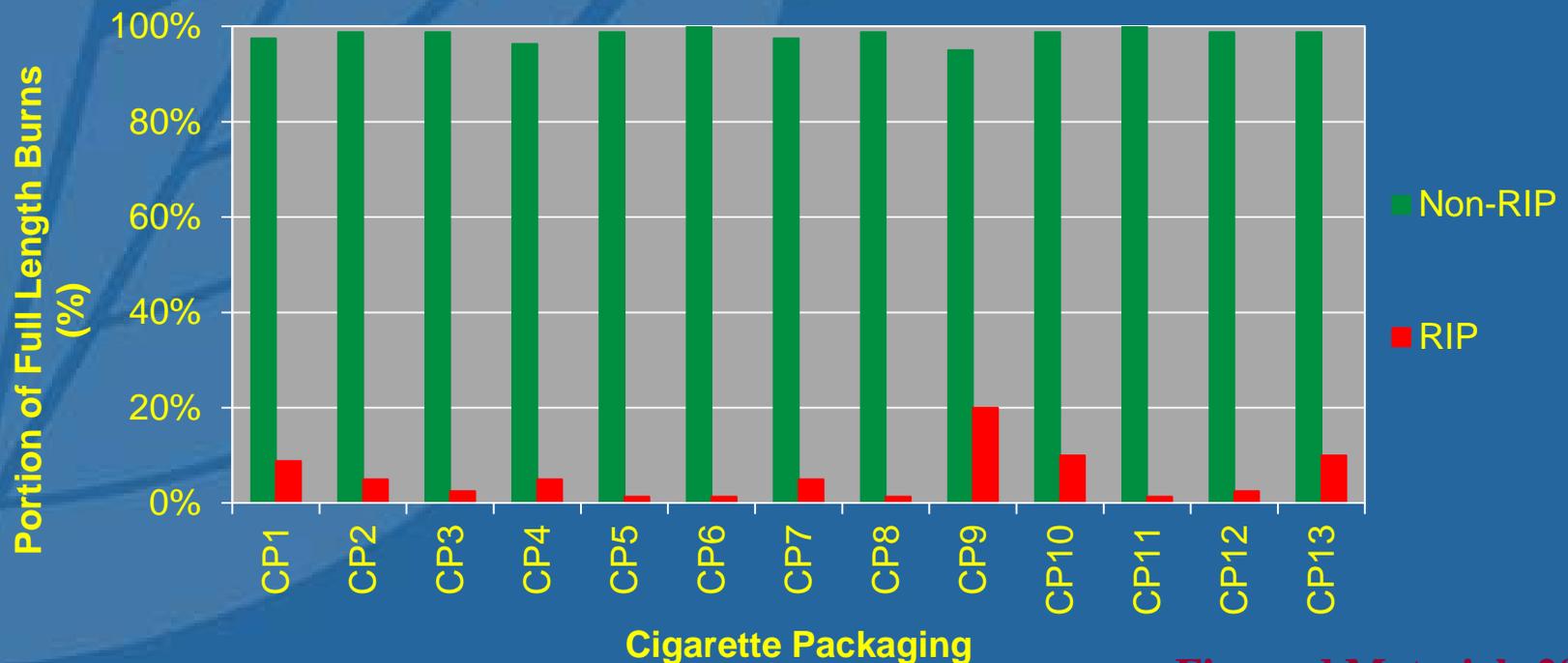
RIP Cigarette Properties

- Additional findings about RIP cigarettes from these samples:
 - band-to-band distance was fairly consistent within most packagings;
 - band location on the tobacco column varied within packagings; and
 - number of bands on a cigarette depends mainly on length of tobacco column and band-to-band distance.



Phase I - ASTM E2187-04 Tests

- Cigarettes from each packaging were tested per ASTM E2187-04 on 10 layers of filter paper.
 - Distinct differences were observed between RIP and non-RIP cigarette full length burns (FLB) per this standard.



PHASE II – TESTS WITH MATTRESS AND MATTRESS PAD SUBSTRATES

- Tests conducted per 16 CFR part 1632 methodology:
 - cigarettes placed on 3 surfaces – smooth, tape edge, and tuft; and
 - on bare mattress or between 2 cotton sheets.
- Metrics observed
 - Smoldering of substrate?
 - Full Length Burn (FLB) of cigarette?
- Experiment designed to find statistical differences between RIP and non-RIP of same packagings.



Phase II - Samples

- Based on the results of Phase I, 4 packagings were chosen to conduct further testing: CP5, CP7, CP9 and CP13.
- 4 mattress and mattress pad substrate brands were chosen based on propensity to smolder.

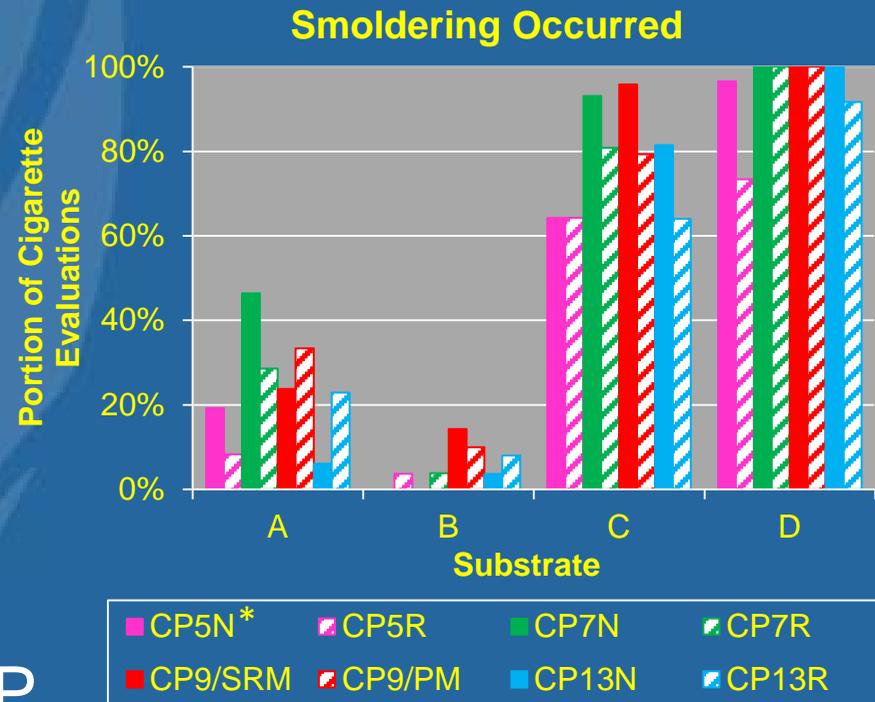
| Substrate Code | Substrate Type | Ticking Type | Fiber Content of Ticking |
|-----------------------|-----------------------|---------------------|---------------------------------|
| A | Mattress Pad | Sateen | Cotton |
| B | Mattress | Twill | Cotton |
| C | Futon | Twill | Cotton |
| D | Mattress | Plain | Cotton |

- 864 cigarettes were tested on 48 substrate samples.
 - 12 samples of each substrate, 18 cigarettes on each.



Phase II – Smolder Data

- 434 of 864 cigarettes resulted in smoldering of the substrate.
- Cigarette packagings did not behave similarly between substrates.
- No consistent practical differences observed between RIP and non-RIP on each substrate.



*Note: non-RIP denoted by “N” and RIP denoted by “R”. CP9/SRM is NIST SRM 1196 and used as the non-RIP version of CP9, CP9/PM is a Pall Mall RIP.



Phase II – Smolder Analysis

- A statistical model was developed to detect a difference between ignition performance of RIP and non-RIP cigarette pairings.
 - Cigarette packaging, substrate, location on substrate, and whether cigarette is covered by sheeting all affect substrate behavior.
 - No overall difference in smolder propensity between RIP and non-RIP cigarettes except for when CP9 packaging was included.



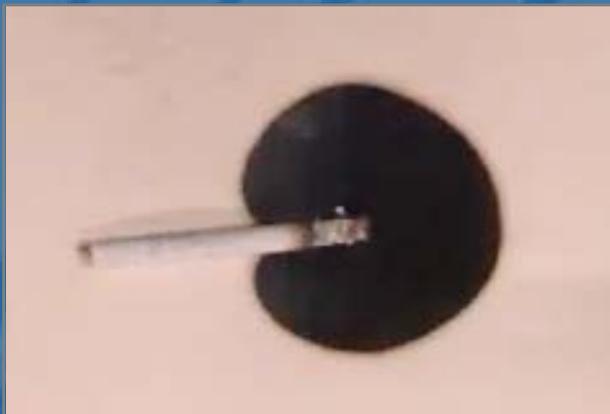
Phase II - FLB Determinations



Mattress and cigarette smolder front simultaneously growing
FLB = Yes



Cigarette burned its full length before mattress started to show char growth
FLB = Yes



Cigarette stopped burning but mattress continued
FLB = No



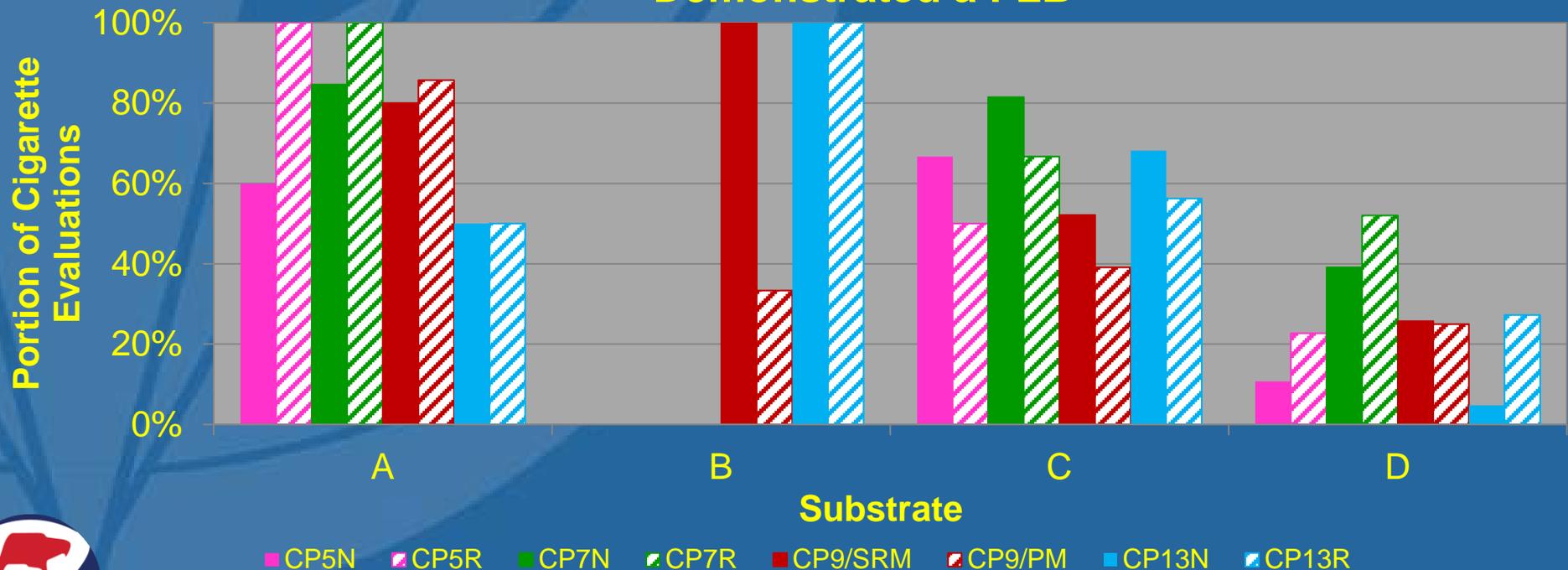
Cigarette and mattress smolder fronts not synced
FLB = Unknown



Phase II - FLB and Smolder Data

- 434 of 864 Cigarettes resulted in smoldering.
 - Many RIP and non-RIP cigarettes caused smoldering despite not showing a FLB.

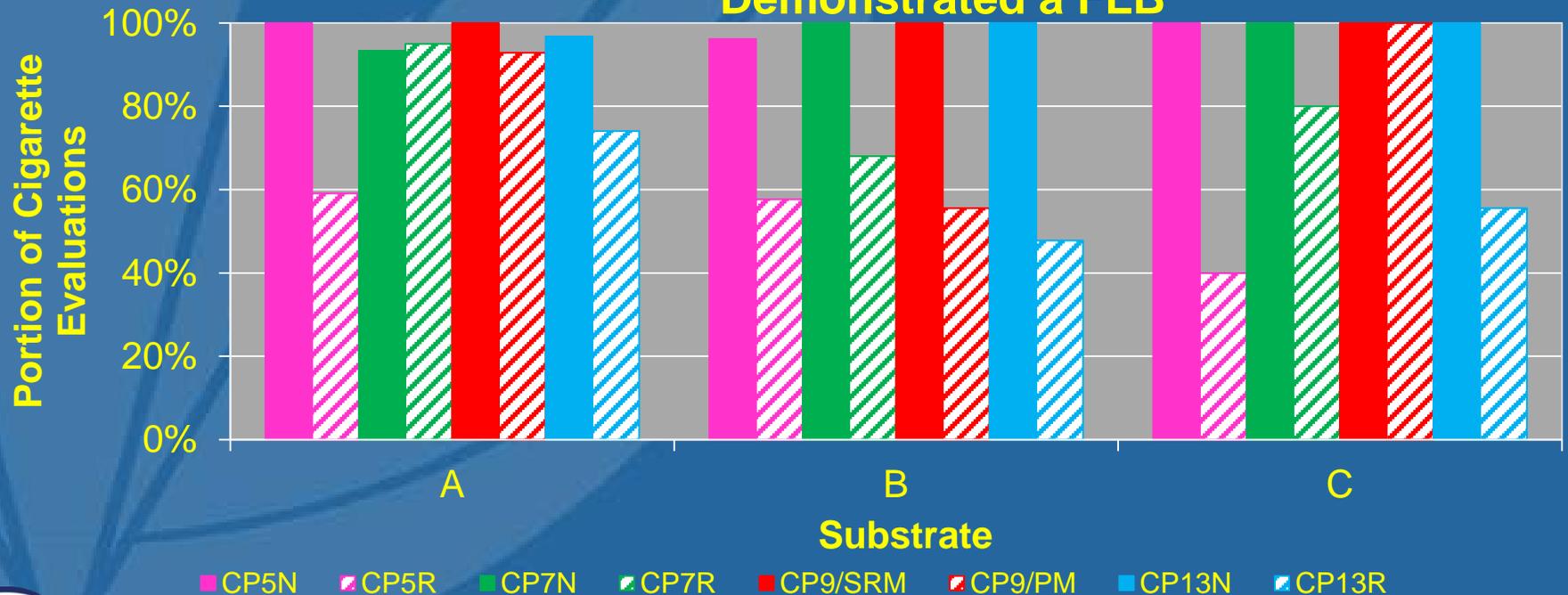
Cigarettes that Caused Smoldering of Substrates and Demonstrated a FLB



Phase II – FLB and No Smoldering Data

- 429 of 864 tests did not smolder
 - Many cigarettes still demonstrated FLB on Substrates A, B, and C.*

Cigarettes that Did Not Cause Smoldering of Substrates and Demonstrated a FLB



*There are no data points for substrate D for these combinations of variables.



Phase II – FLB Analysis

- The statistical model also examined the FLBs of RIP and non-RIP cigarettes.
- Statistically significant FLB effects
 - RIP effect,
 - substrate type,
 - cigarette packaging,
 - location.
- Statistically significant interaction between
 - substrate type and the RIP cigarette,
 - substrate and sheeting,
 - location and the RIP cigarette, and
 - location and sheeting.

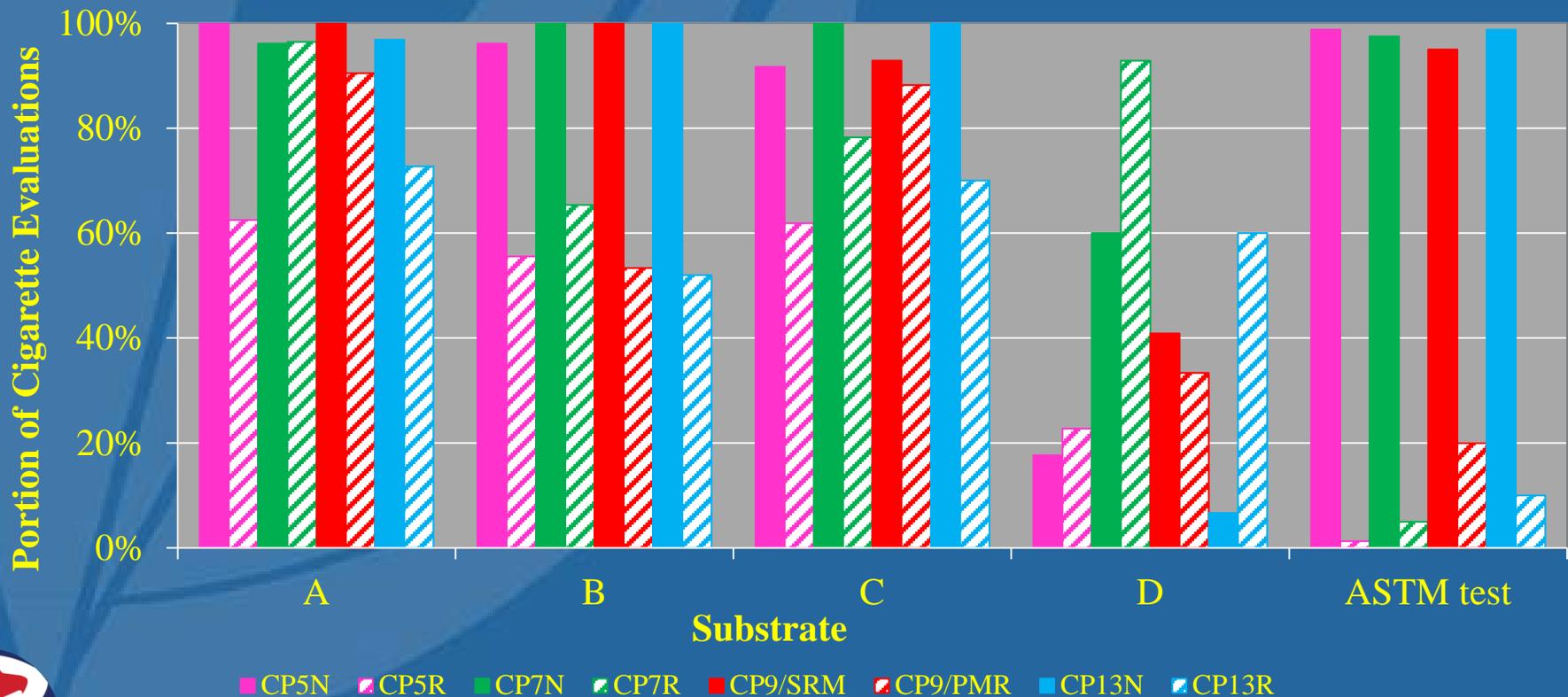


Phase I and Phase II Comparison

- Magnitudes of FLBs per ASTM do not match FLBs on these substrates

(all Phase I and II tests are included in this comparison)

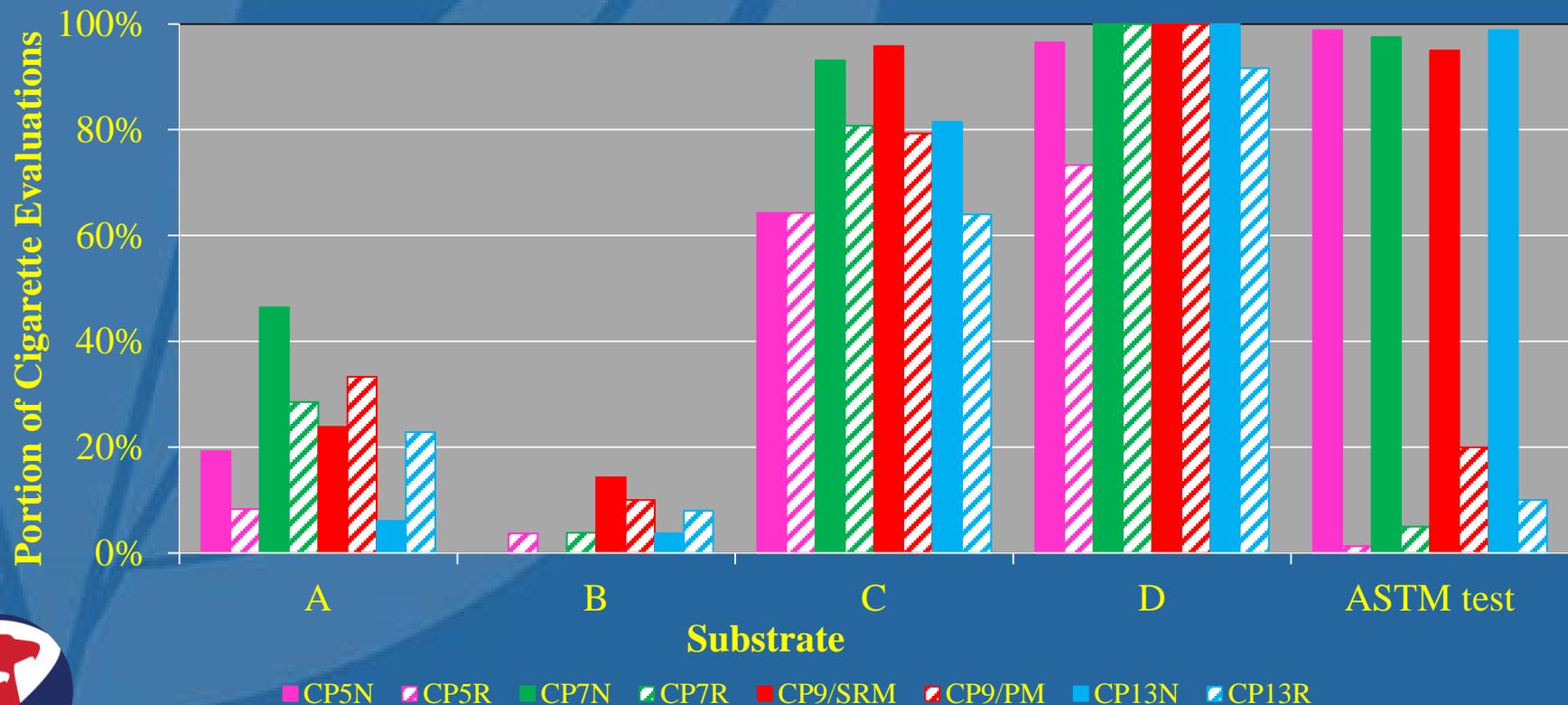
FLB for all Mattress/Pad Substrates and ASTM Substrate



Phase I and Phase II Comparison

- FLB portions per the ASTM E2187-04 methodology does not necessarily predict whether smoldering will occur on these substrates.

Smoldering for all Substrates and ASTM FLB



Testing Conclusions

1. The RIP cigarettes of different packagings did not demonstrate similar FLB performance on all substrates.
2. No statistically significant overall difference between RIP and non-RIP cigarettes' propensity to cause smoldering of the tested mattress/pad substrates.
 - Except when the CP9 packagings are included in the model.
3. Cigarette packaging, substrate brand, and location of the cigarette on the substrate were all significant.
4. Portions of FLBs on 10 layers of the ASTM E2187-04 filter paper substrate did not predict either the FLB or smoldering behavior on the mattress/pad substrates.



Overall Conclusions

- RIP cigarettes may not greatly reduce the threat of unintentional cigarette-ignited fires involving soft furnishings.
- At this point, it's not clear that RIP cigarettes reduce the hazard that the CPSC standards address.



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