U.S. Consumer Product Safety Commission

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

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*This information was prepared by the CPSC staff; it has not been reviewed or approved by, and does not necessarily represent the views of, the Commission.

U.S. Consumer Product Safety Commission (CPSC)

- CPSC is an independent federal 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;
  - 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 and other consumer products that may be 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 (73 FR 11702, March 4, 2008).
- 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.

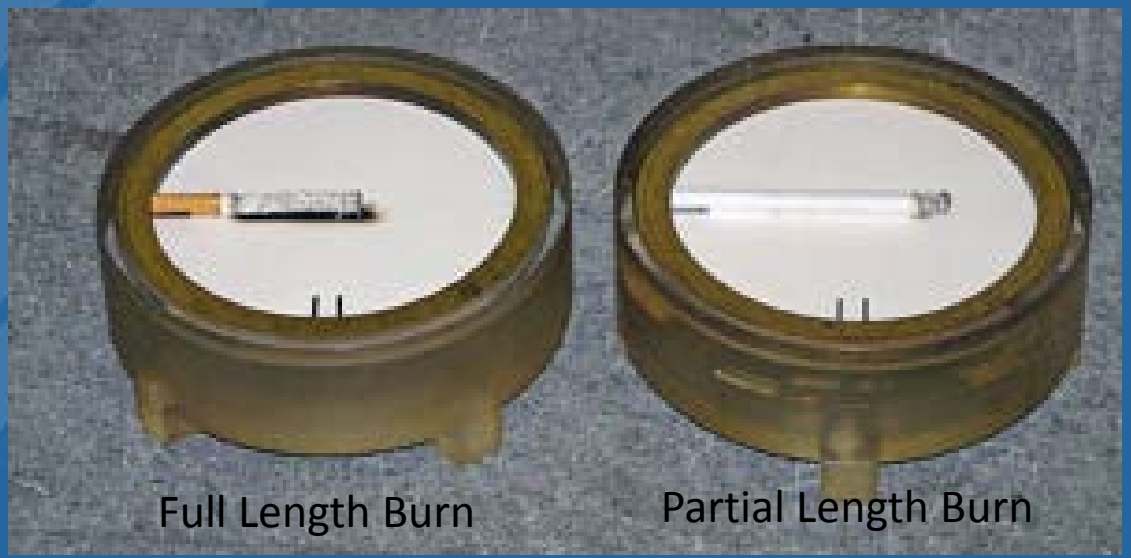
- In 2007, CPSC staff learned cigarette manufacturers were phasing out cigarettes that did not meet the state laws, effectively changing the cigarette market.

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.



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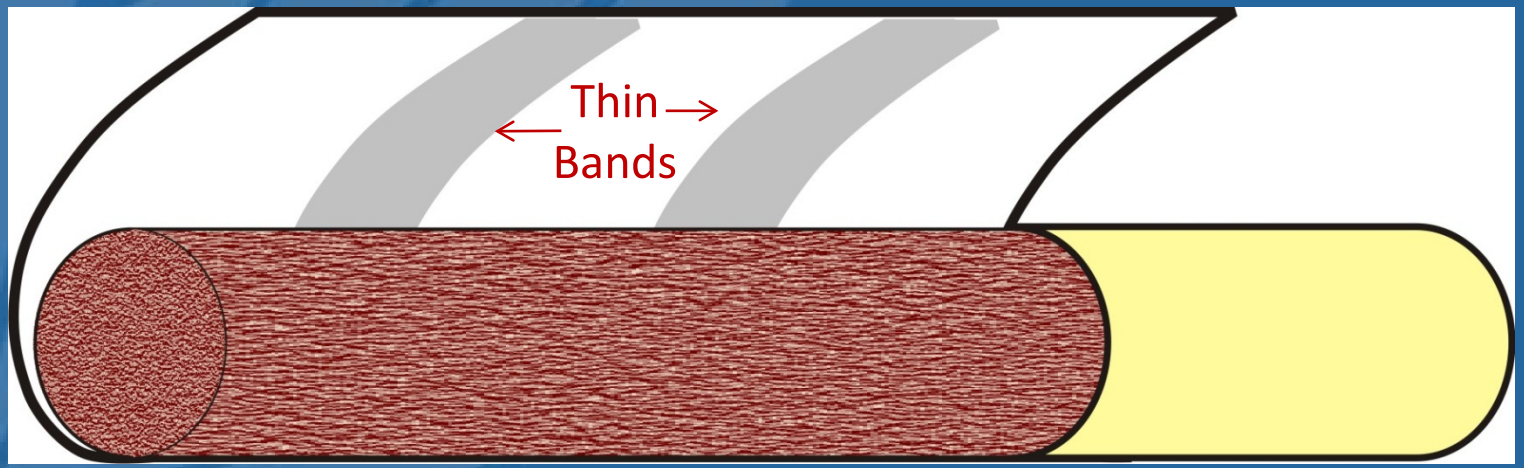
RIP Design

- Typically, the paper along the RIP cigarette's tobacco column has two or three thin bands of less porous paper.



CPSC Task Outline

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

Cigarette Selection

- Samples of RIP/non-RIP cigarettes were collected of these 13 cigarette packagings 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

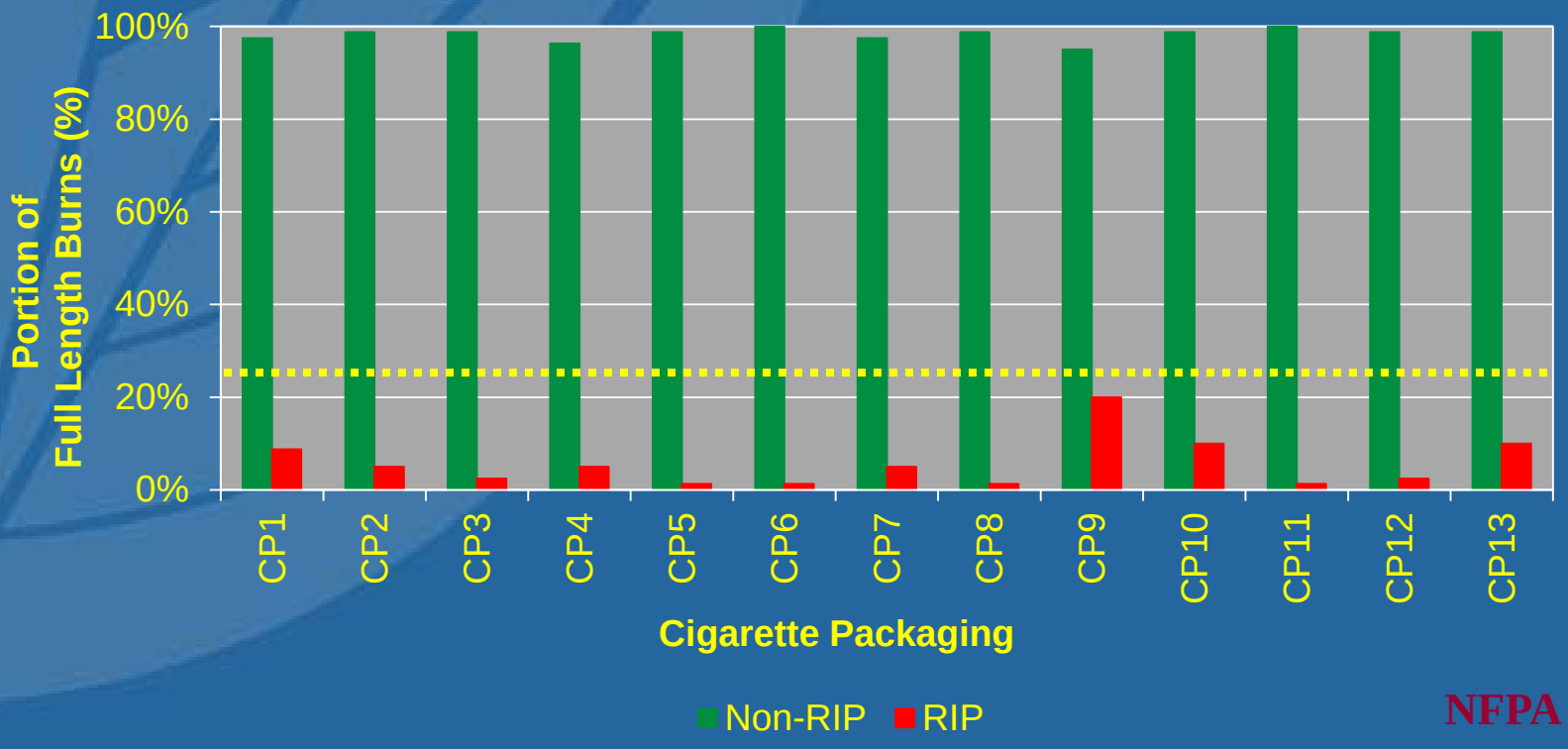
- RIP and non-RIP cigarettes of each packaging were not significantly different:
  - tobacco column length and density did not vary;
  - burning temperature differences were not statistically significant; and
- Air permeabilities and citric acid levels in the cigarette paper were too variable within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

RIP Cigarette Properties

- Additional findings about RIP cigarettes observed 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 depended 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.

Style 1

Style 2

Phase II - Design

- Metrics observed
  - Smoldering of substrate?
  - Full Length Burn (FLB) of cigarette?
- Experiment designed to determine if there were any statistical differences between RIP and non-RIP cigarettes of same packagings.

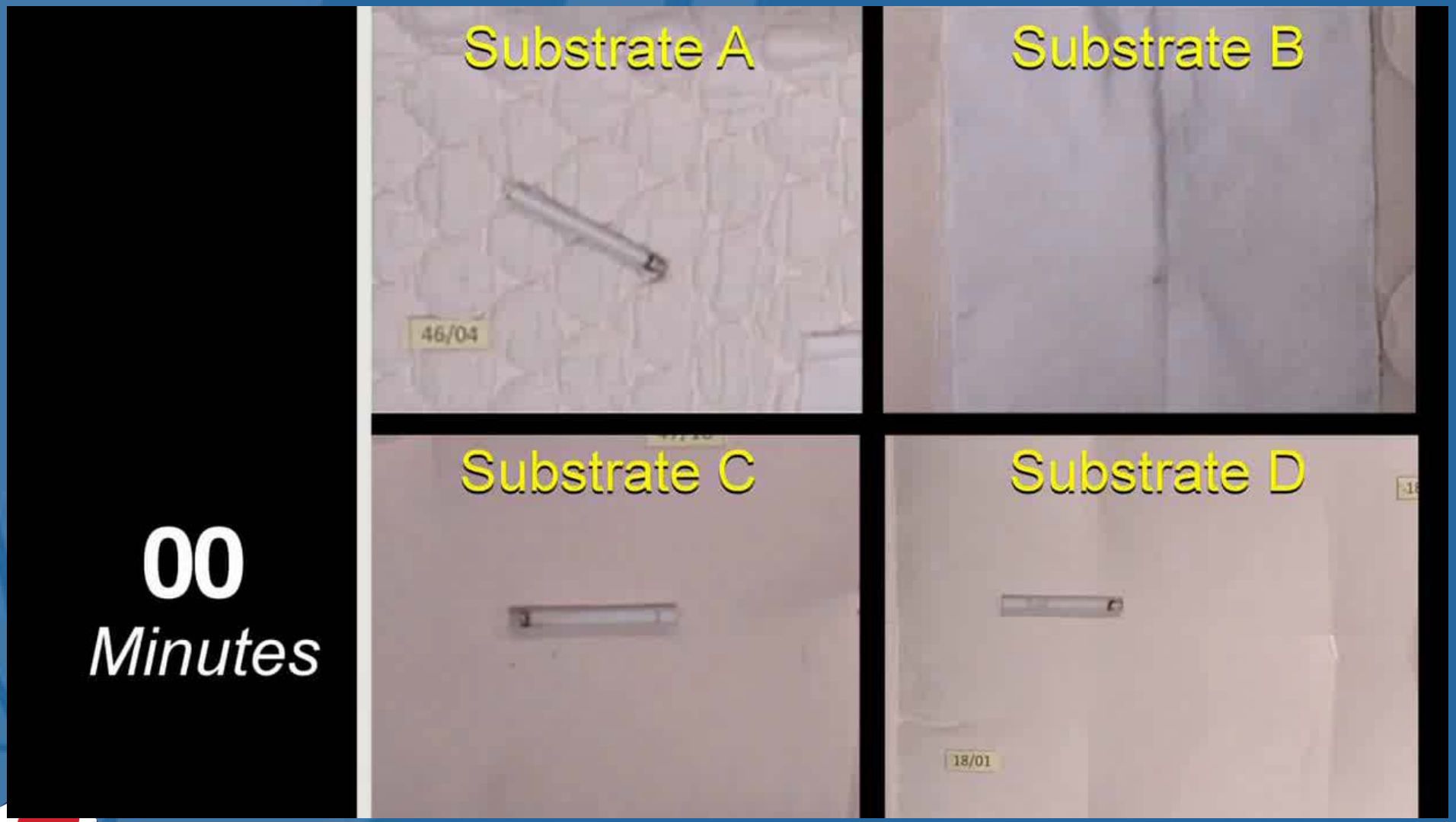
Phase II - Samples

- 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

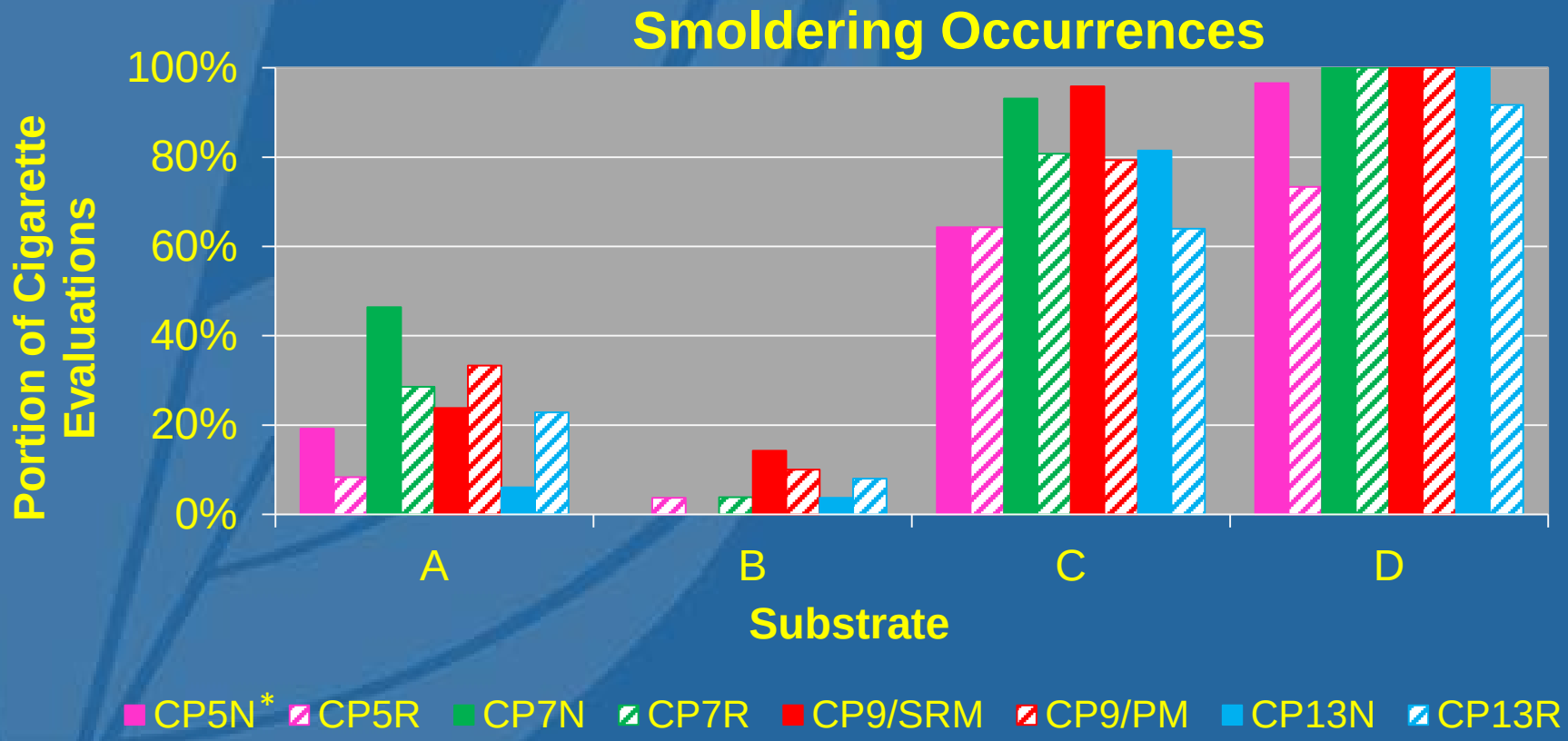
- 864 cigarettes were tested on 48 substrate samples.
  - 12 samples of each substrate, 18 cigarettes on each.

Example of Smolder Progression on Substrate



Phase II – Smolder Data

- 434 of 864 cigarettes resulted in smoldering of the 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.

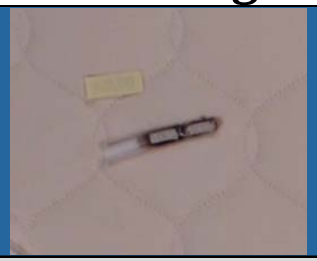
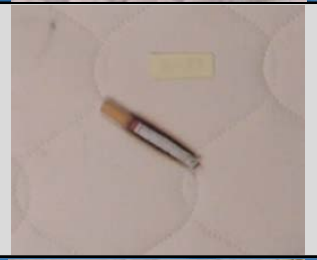
Phase II – Smolder Data Results

- Cigarette packagings did not behave similarly between substrates.
- No consistent practical differences observed between RIP and non-RIP on each substrate.
  - The relative difference between the number of smoldering ignitions is not the same between the substrates of the same packaging, and
  - In some cases, the RIP cigarettes of a packaging caused more smoldering ignitions than its non-RIP counterpart.

Phase II – Smolder Analysis

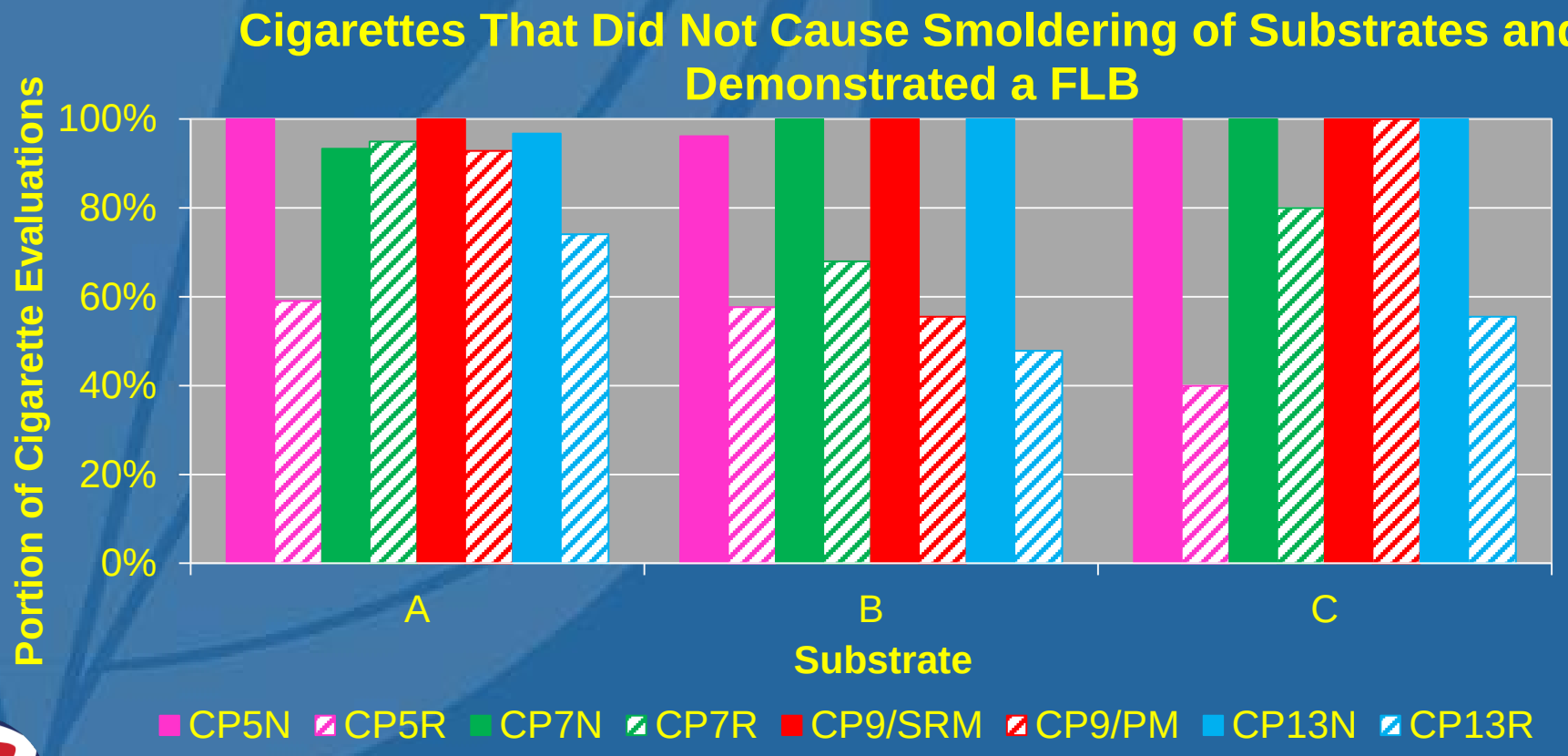
- A statistical model was developed to detect whether there was a statistical difference between ignition performance of RIP and non-RIP cigarette pairings.
  - Cigarette packaging, substrate, location on substrate, and whether cigarette is covered by sheeting all affect substrate smoldering.

Phase II – FLB Determinations for No Smoldering Occurrences

Cigarette ID	Non-RIP		RIP	
	Without Sheeting	With Sheeting	Without Sheeting	With Sheeting
CP5				
CP7				
CP9				
CP13				

Phase II – FLB and No Smoldering

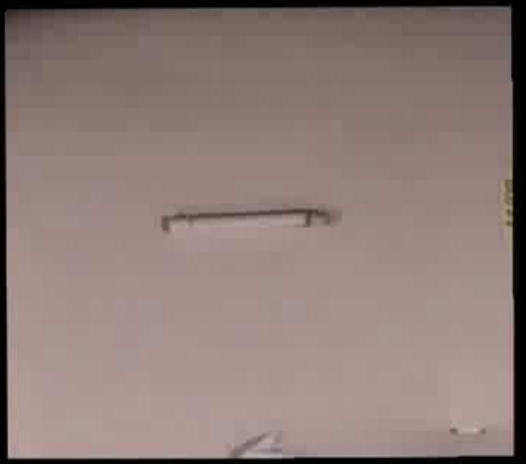
- 429 of 864 tests did not smolder
  - Many cigarettes demonstrated FLB on Substrates A, B, and C.*



*All data for substrate D for these combinations of variables are zero.

Phase II - FLB Determinations for Smoldering Occurrences

Mattress and cigarette smolder front simultaneously growing
FLB = Yes



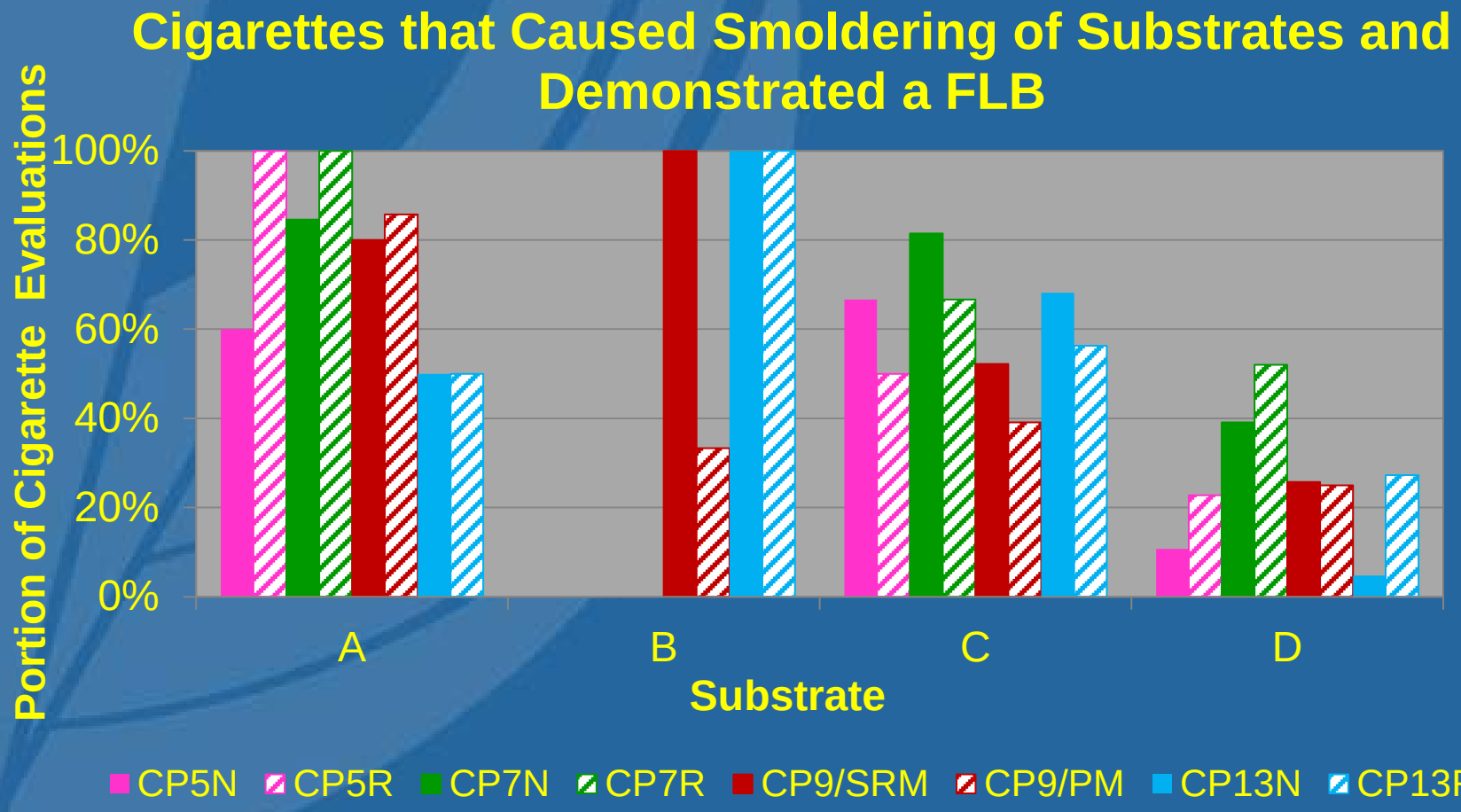
Cigarette burned its full length before mattress started to show char growth
FLB = Yes

Cigarette stopped burning but mattress continued smoldering
FLB = No

Cigarette and mattress smolder fronts not synched
FLB = Unknown

Phase II - FLB and Smoldering

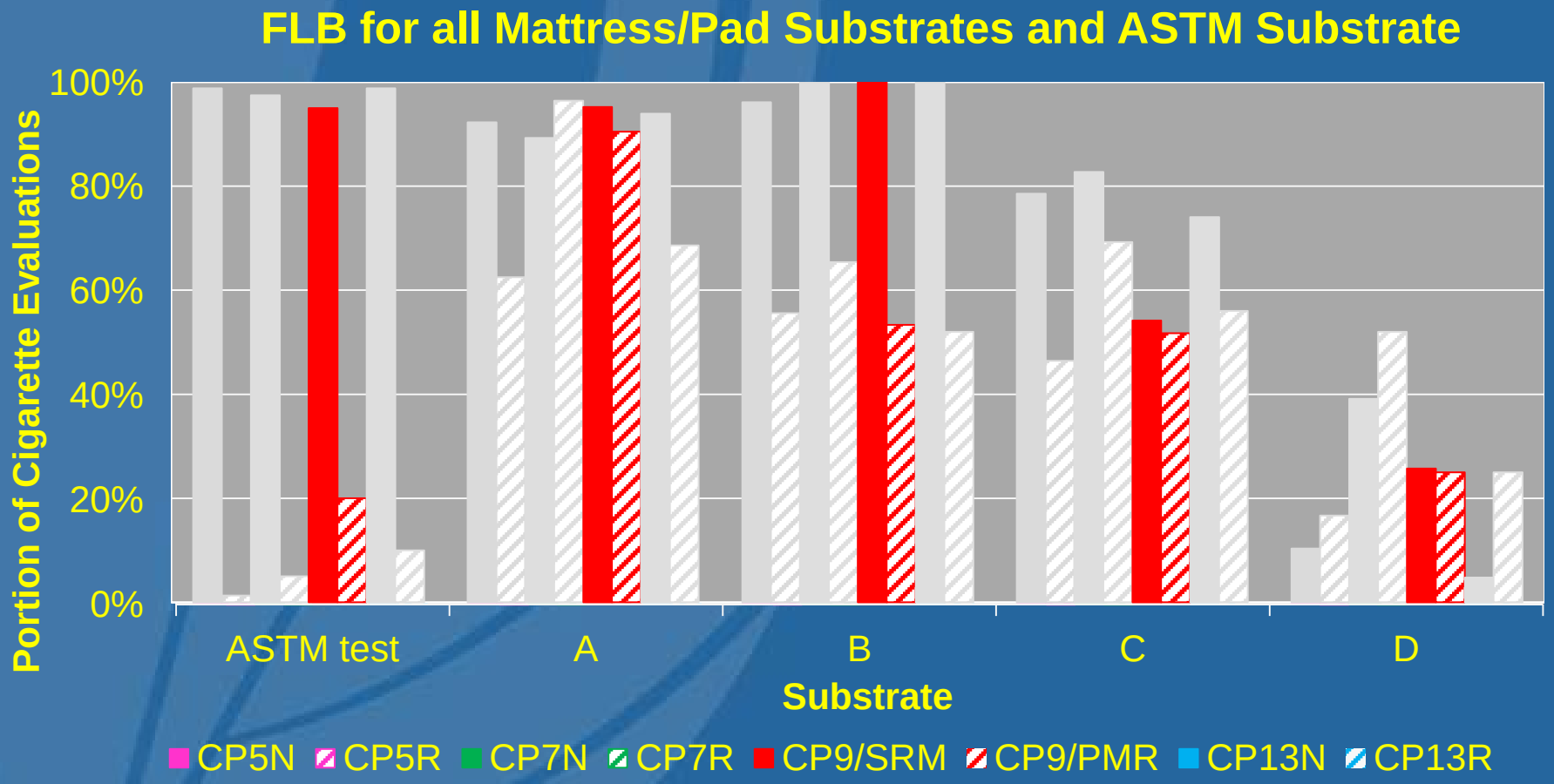
- 434 of 864 cigarettes resulted in smoldering.



Phase II – FLB Analysis

- The statistical model examined the FLBs of RIP and non-RIP cigarettes.
- Statistically significant FLB effects
  - RIP/non-RIP,
  - substrate type,
  - cigarette packaging, and
  - 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

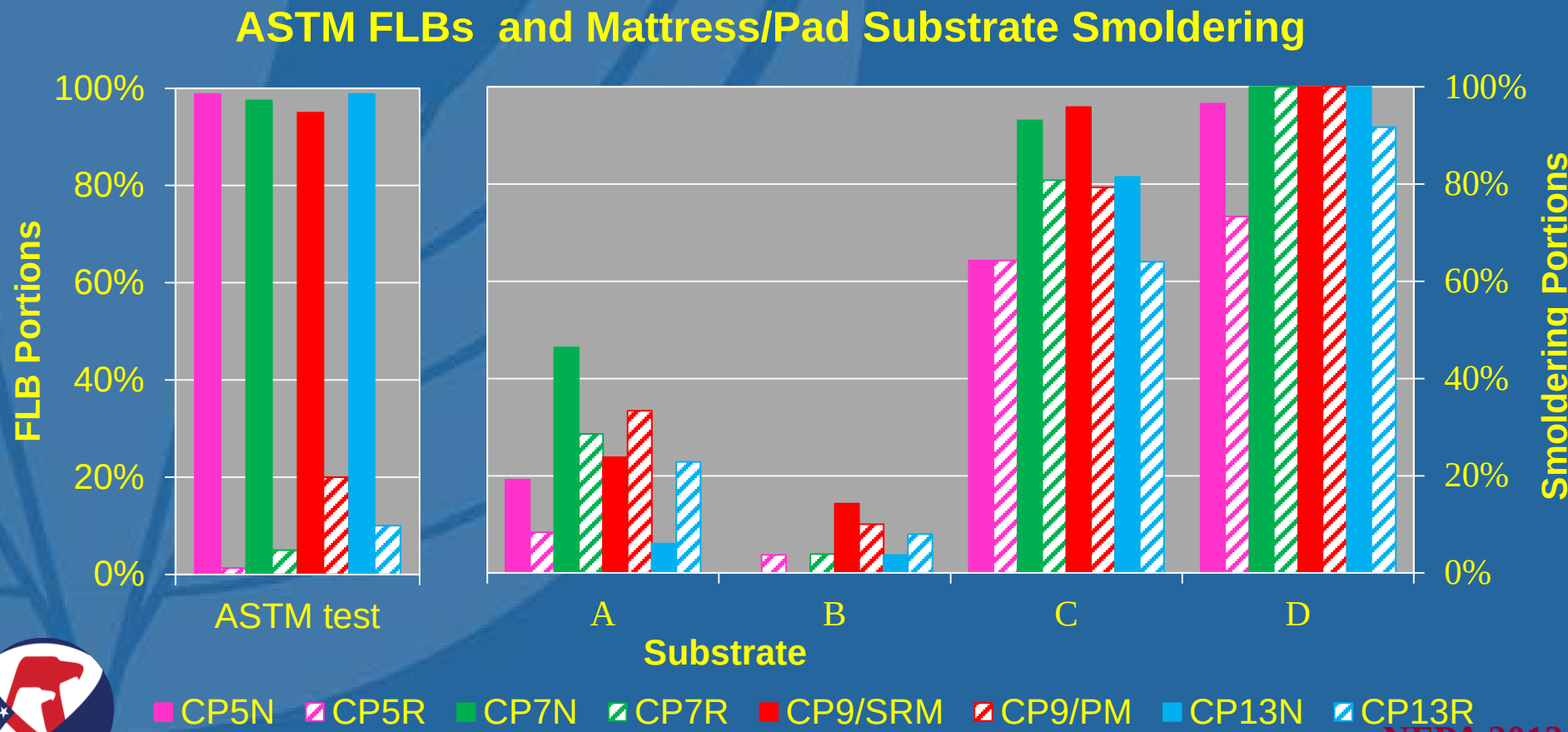


- Magnitudes of FLBs per ASTM do not match FLBs on these substrates

*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 I and Phase II Comparison

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



Testing Conclusions

1. The RIP cigarettes of different packagings did not demonstrate similar FLB performance on all substrates.
2. Cigarette packaging, substrate brand, and location of the cigarette on the substrate and RIP/non RIP all had statistically significant effects on smoldering and FLBs.
3. Portions of FLBs on 10 layers of the ASTM E2187-04 filter paper substrate did not predict the FLB behaviors on the mattress/pad substrates tested here.
4. A low level of FLBs on ASTM filter paper did not coincide with the smoldering behavior of 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 is not clear that RIP cigarettes reduce the hazard that the CPSC standards address.

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For further information contact
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