Low Ignition Propensity Regualtion: History and Implications

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Low Ignition Propensity (LIP): History and Implications

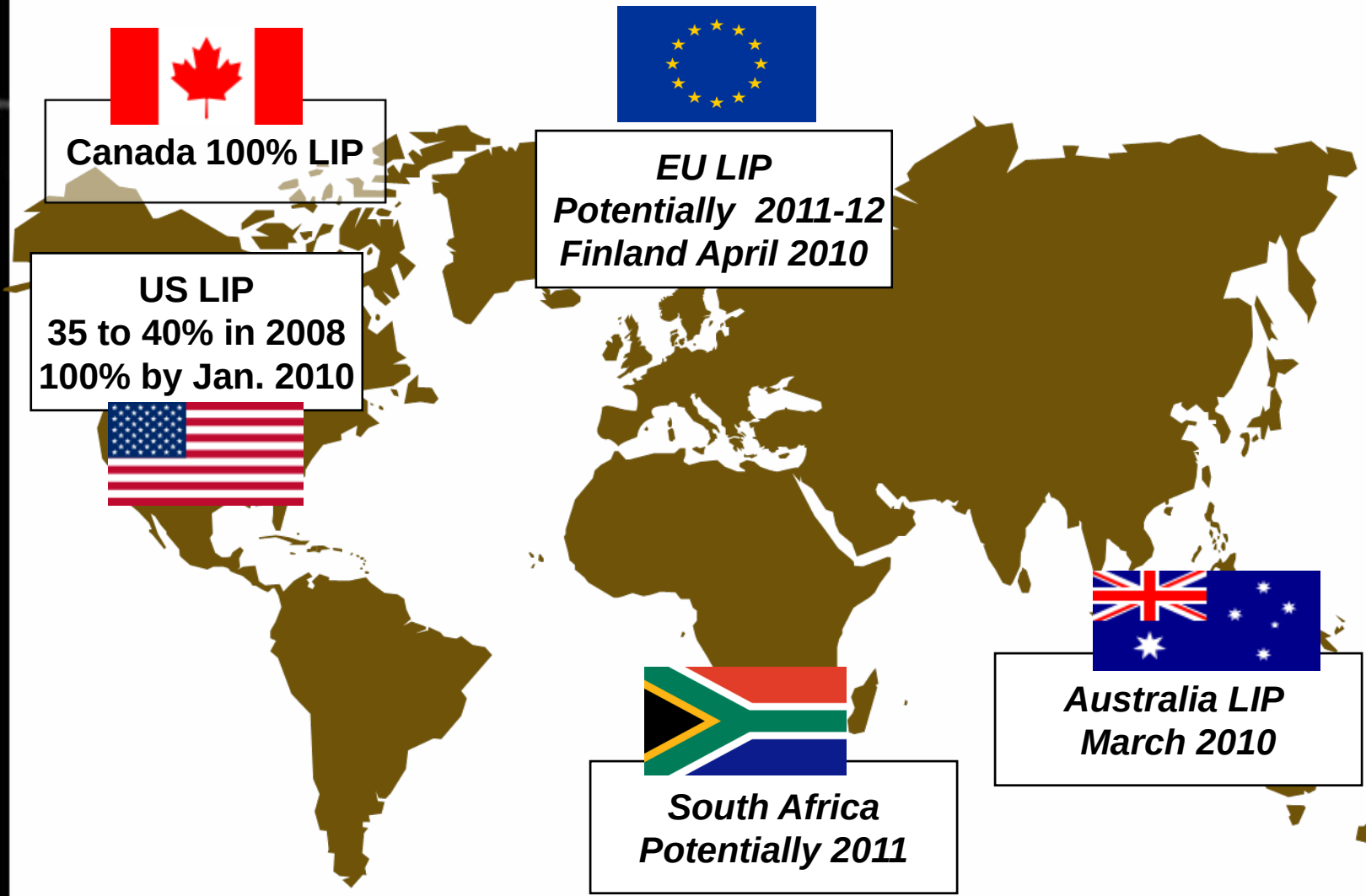
Agenda

- Introduction
- Technical Study Group (TSG)
- Technical Advisory Group (TAG)
- ASTM E2187 Test Method
- Tobacco Column Properties that Impact LIP
- Conclusions

Introduction

- NY State was the first to mandate regulations for Low Ignition Propensity cigarettes as of June 28, 2004
- Now 49 of 50 US states have passed similar regulations
- Canada was the first country to adopt such regulation in 2005
- All LIP regulations are based on ASTM E-2187
- Regulations mandated no more than 25% full length burns on 10 layers of Whatman #2 filter paper
- Many other countries adopted or are considering similar regulations

Global LIP Expansion



Introduction: Time - Line

- 1984----Fire Safe Cigarette Act: Technical Study Group Formed
- 1987-----TSG Report Issued
- 1988-----CORESTA Task Force Organized: 8 Studies
- 1990-----Technical Advisory Group Formed to Develop Test Method
- 1993-----TAG Report Issued
- 1998-----ASTM – Task Group to Recommend a Test Method
- 2004-----NY Implemented Regulations – June ‘04
- 2005-----Canada Implemented Regulations – Oct ’05

Technical Study Group (TSG)

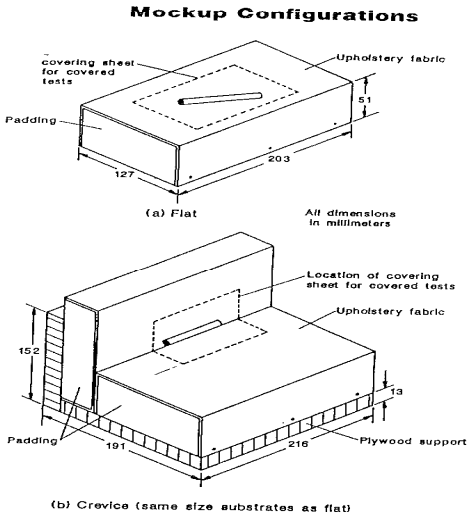
Technical Study Group (TSG)

- Congress passed the first Cigarette Safety Act of 1984 establishing the TSG
- One of its main tasks was to identify cigarette characteristics that could lead to a reduction in ignition propensity
- The TSG issued its final report in 1987
- The report identified cigarette properties that had reduced ignitions on furniture mockups and full scale replicates
- The report recommended the formation of second group to develop a test method

TSG

- Total of 46 experimental cigarettes were evaluated. Results focused on 32 experimental cigarettes
- Three fabrics were tested over polyurethane and cotton batting in mockup configurations

TSG: Mock Configuration



R. Gann & co-authors, The Effect of Cigarette Characteristics on the Ignition of Soft Furnishings, Vol. 3, 1987 NBS

Ignition Propensity as a Function of Cigarette Parameters: 32 Experimental Cigarettes

Cigarette Parameter	Property	Number of Ignitions	% Ignition
Tobacco Column Density (mg/cc)	High 230 – 320	282	88
	Low 130 – 210	153	48
Paper Permeability (CU)	High 66 – 78	256	80
	Low 8 – 10	179	56
Cigarette Circumference (mm)	25	243	76
	21	192	60
Paper Citrate (%)	0.8	231	72
	0	204	64
Tobacco Blend	Flue Cured	222	69
	Burley	213	67

R. Gann & co-authors, The Effect of Cigarette Characteristics on the Ignition of Soft Furnishings, Vol. 3, 1987 NBS

TSG Findings

- Tobacco column density and paper permeability were most important factors in reducing ignitions
- Five cigarettes were tested on full scale furniture as well as mockups prepared with the similar construction material: Study concluded that results had very good correlation
- One section was dedicated to the study of the thermophysics and another to modeling the ignition process
- A number of test methods were evaluated to gauge the cigarette ignition process: mockups, filter paper, glass plates

Technical Advisory Group (TAG)

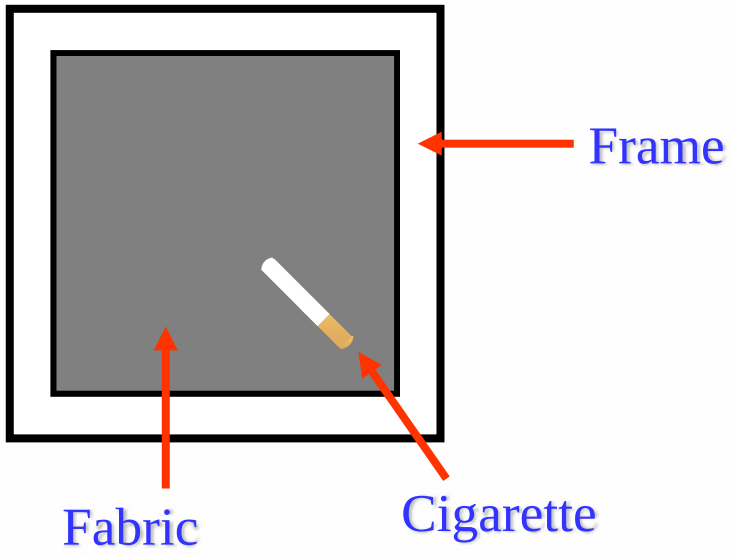
Technical Advisory Group (TAG)

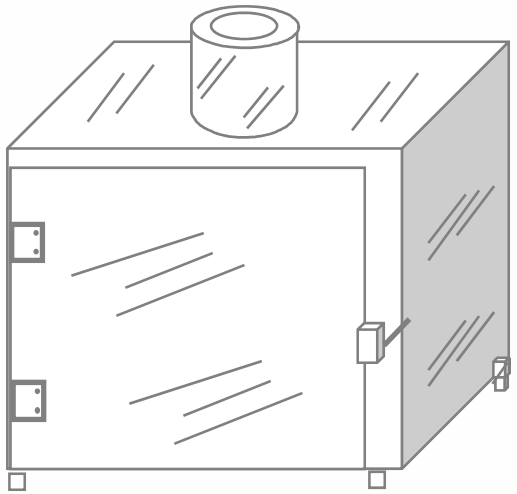
- Congress passed the Fire Safe Cigarette Act of 1990 establishing the TAG
- Tasks were assigned to NIST and CPSC
- NIST: Develop a standard test method to determine cigarette ignition propensity; compile cigarette performance data; perform ignition physics studies and develop a user friendly computer model
- CPSC: Collect data on properties of cigarettes, products and smokers involved in fires; develop information on cigarette fire costs; develop information on changes in toxicity and resultant health effects from cigarette prototypes

TAG – Mockup Ignition Test Method

- Thousands of commercial fabrics are available
- Test method fabrics have to be susceptible to ignition, differentiate among various cigarettes, provide reproducible results, readily available now and in the future with consistent properties, and representative of commercial fabrics
- NIST selected three cotton duck fabrics: #4, #6, and #10
- Duck fabrics ignition propensity: #4 < #6 < #10
- The main difference among the three fabrics is their areal density – #4: 830gm/m^2, #6: 720gm/m^2, #10: 500gm/m^2
- Potassium ion content in duck fabrics: 4400 – 5700ppm

TAG – Mockup Ignition Test Method





Mock-Up Assembly

Mock-Up Enclosure

TAG – Cigarette Extinction Test Method

- Provide a simple and consistent material for a test method
- Whatman #2 filter paper is used at 3, 10, and 15 layers
- Outcome: Cigarette self extinguishes or burns to completion
- Nine labs participated in an interlaboratory study using the two methods
- The report concluded that cigarette performances were roughly correlated to those obtained with Mockup Ignition Test Method

Extinction Test Assembly

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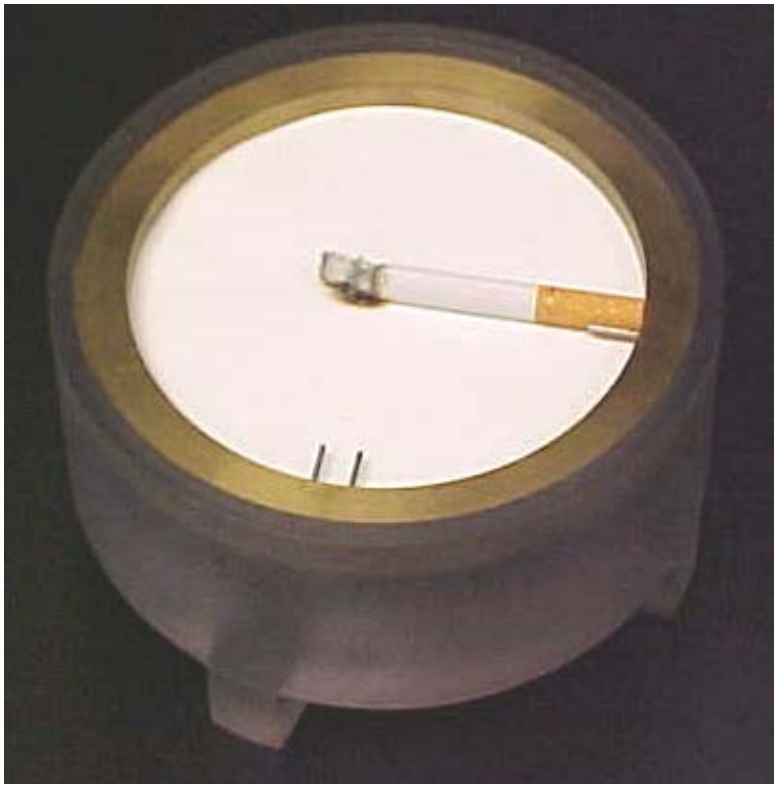
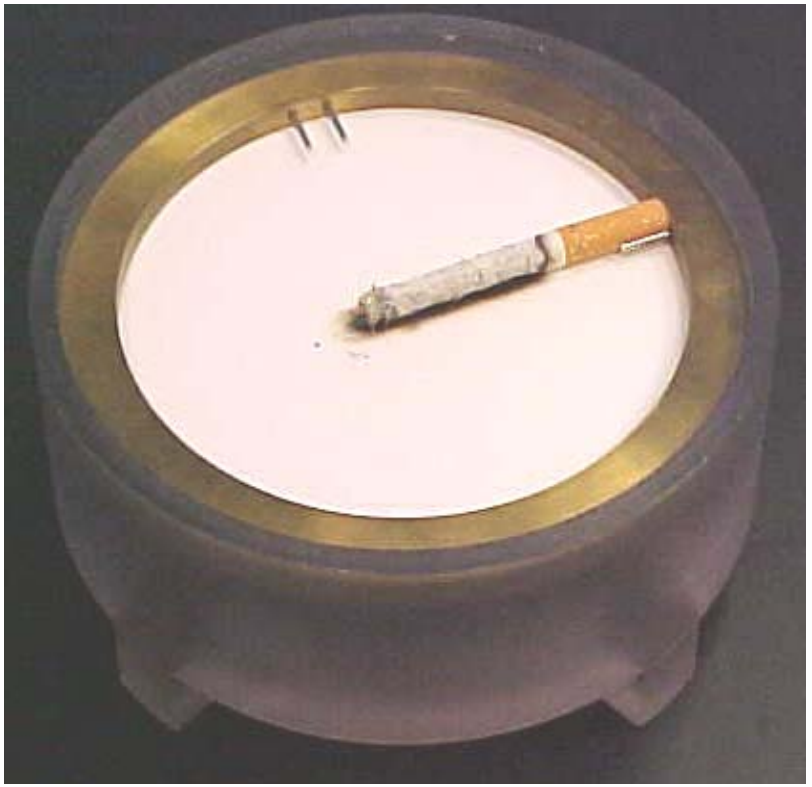
Possible Outcomes of Extinction Test



Pass



Fail

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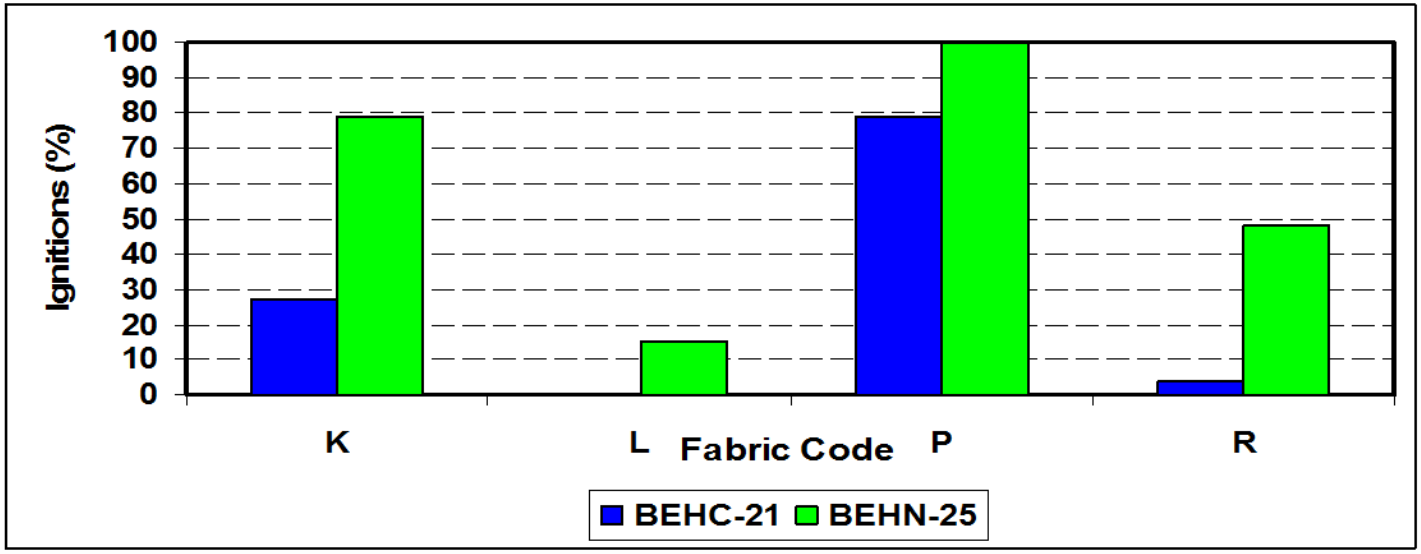
Cigarette Ignition Studies: Fabrics and Environmental Factors

- Many studies were published on cigarette ignition performances on various commercial fabrics and compared to duck fabrics
- Roll-to-roll variability of duck fabrics was large enough to produce different and non-consistent results
- Other studies ranked cigarette on commercial fabrics in different orders than duck fabrics
- Other studies examined impact of air flow on the ignition process
- NIST selected an enclosure to prevent air currents and countered that cigarette rankings for majority of the fabrics were consistent with the two proposed test methods

Duck #6 Variability

Duck #6				
Code	K	L	P	R
Areal Density (gm/m^2)	700	746	671	722
Potassium (ppm)	6428	5300	5522	5913
BEHC-21 (% Ign.)	27	0	79	4
BEHN-25 (% Ign.)	79	15	100	48



J. Wanna & Co-authors, Effect of Cotton Duck #6 Inter-Bolt Variability on Cigarette Ignition Propensity Test Outcome, J. Fire Sciences, 14, 1996

ASTM E2187 Test Method

The ASTM Test Method E2187 – 04

- The Mockup Ignition Test and the Cigarette Extinction Test Methods were submitted to ASTM for adoption
- The task group on the Mockup Ignition Test discontinued the effort due to lack of progress and unavailability of uniform fabrics
- ASTM adopted the Cigarette Extinction Test method as ASTM standard E2187-02b, which was replaced by E2187-04

Tobacco Column Properties that Impact LIP

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Tobacco Column Properties that Impact LIP

- To pass LIP regulation the tobacco column had to be modified: cigarette paper, blend and/or both
- Altering the tobacco column is challenging and has to be carefully done so as not to lose brand identity as it will impact smoke chemistry, taste, and other smoking criteria

Compliance Through Blend Modification

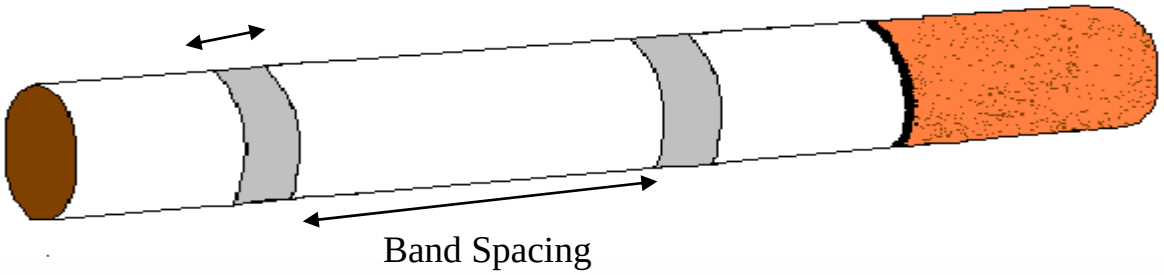
- Tobacco blends impact mass and smolder rate which in turn influence performance on the ASTM test method
- Blend additives: Effective at high levels, new ingredient, taste issues, alter deliveries, manufacturing changes
- Altering blend only does not produce sufficient impact to pass required regulation

Compliance Through Cigarette Paper Modification

- Cigarette paper acting as a barrier to oxygen diffusion to the coal has a major influence on cigarette burn properties and ignition performance
- In LIP tests, paper diffusion measured at pressure equilibrium across the paper is more relevant than cigarette permeability measured with a pressure differential
- Cigarette paper's critical role made it the primary means of use to pass the ASTM test method

Bands Applied to Cigarette Paper

- Bands applied to cigarette paper reduce the diffusion of air through the band area to the combustion zone
- Generally, bands are between 5 to 7mm wide with a 18 to 20mm spacing



Desired Properties of Cigarette that Meet Regulation

- Pass ASTM E2187 test and other regulations (e.g. 10-1-10)
- No self-extinguishing when burning in air or placed in an ashtray
- Appearance, opacity, ash, & burn properties similar to control
- Acceptable taste and other subjective attributes
- No change in smoke chemistry or biological activity
- Passes all stewardship testing
- Minimal or no cigarette design changes
- No reduction in manufacturing efficiencies

Conclusions

Conclusions

- In 1987 the TSG identified cigarette properties that impact cigarette ignitions: mainly tobacco density, paper porosity, cigarette circumference
- In 1993 TAG proposed two test methods: The Mockup Ignition Test and the Cigarette Extinction Test methods
- In 2002 ASTM adopted the Cigarette Extinction Test method at E2187
- In 2004 first regulation requiring cigarette to pass a standard test method: 75%SE on 10 layers of Whatman #2 filter paper
- Regulations are spreading to many countries
- Almost all cigarettes use cigarette paper with low diffusion bands to meet the required regulation