



ISO/TC 126/WG 10 N 40

[ISO/TC 126/WG 10](#)

Intense smoking regime

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Further data on cigarette temperatures and related issues - Presentation S Purkis

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Expected action

Info

Further data on cigarette filter temperatures and related issues

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Background

- Presentations by Derek Mariner and Mike Ogden
 - Nicotine “yield in use” data was found to be, on average, most similar to the machine smoking nicotine yield under the MA regime.
 - Both the Canadian and Option B machine smoking regimes fairly well represented the maximum human nicotine “yield in use”.
- My presentation
 - Reasons explained why the similarity of nicotine yields between Canadian and Option B was unlikely to be true for vapour phase components and the caution required in interpreting results
 - High temperatures in the cigarette generated under the Canadian regime with unrealistic 100% vent blocking.
- This presentation
 - further cigarette temperature data
 - some further perspectives.

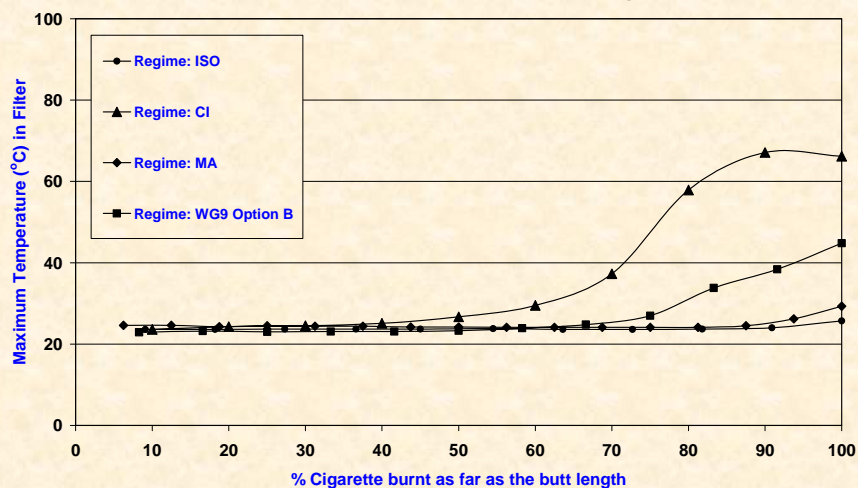
Experimental

1mg tar yield (ISO) cigarettes used

- Cigarettes smoked under ISO, MA, CI and WG9 Option B (60ml puff every 30 seconds with 50% vent blocking) regimes
- Smoke Temperature measured 20mm and 5mm from mouth end with a resistor based temperature sensor inserted into the cigarette filter

Smoke Temperature Data

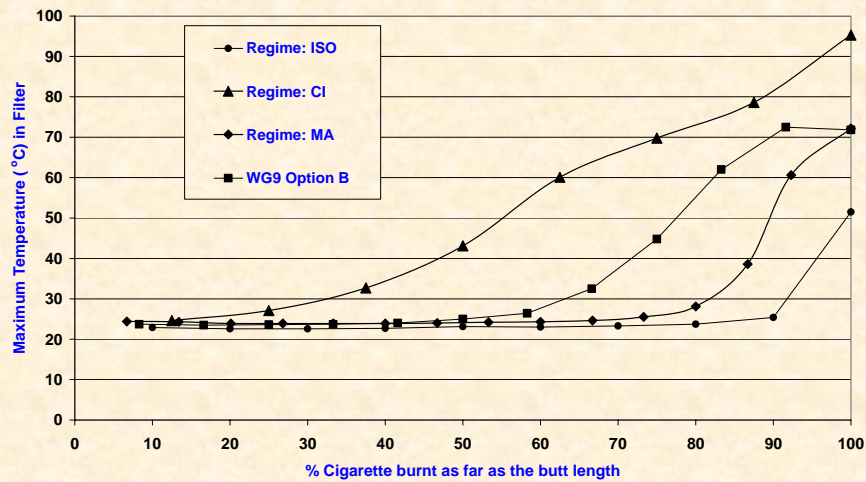
Cellulose Acetate Filter, 5 mm from mouth end, 1 mg Tar (ISO)



Temperatures generated when machine smoking under Option B are lower than the Canadian regime even with the larger 60ml puff volume
- due to the diluting air through the ventilation holes cooling the smoke

Smoke Temperature Data

Cellulose Acetate Filter, 20 mm from mouth end, 1 mg Tar (ISO)



Temperatures again higher under the Canadian regime and are observed over the whole course of the cigarette being smoked.

Conclusions / Questions on temperature measurements in cigarette filter

- Canadian regime leads to higher temperatures in the filter than under all the other regimes where air through the ventilation holes cools the hot smoke.

Does human smoking behaviour during the course of smoking the cigarette generally lead to these high smoke temperatures ?

..... and if not are there other factors involved?

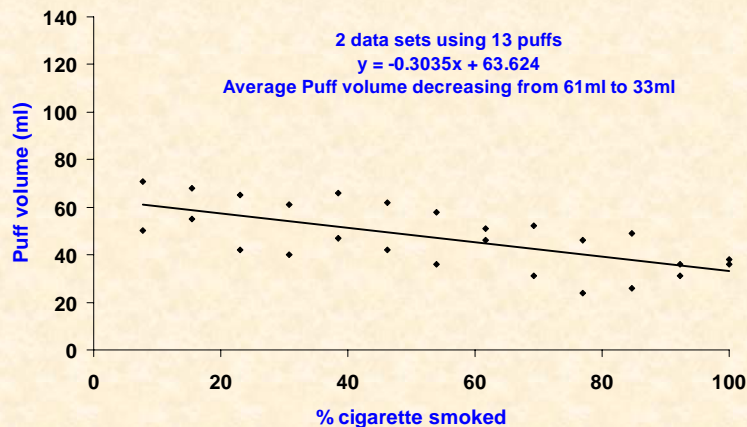
Human Smoking Puff Volumes

Data from ITG Research in 1986

- 11 smokers smoking 4 replicates of a 15mg tar yield (ISO) commercial cigarette
- “Ad libitum” smoking in panel lounge
- Puff volumes recorded on a per-puff basis
 - Monitored by computer every 1/50th second
 - Used filter flow sensor integral to the cigarette
 - Each smoker often smoked the cigarette differently on different occasions

Smoker	Average puff number (range)	Average puff volume
1	9.0 (7-11)	57
2	10.8 (9-12)	35
3	11.3 (10-13)	43
4	8.3 (7-10)	64
5	10.3 (10-11)	50
6	10.8 (8-12)	47
7	10.5 (9-12)	50
8	11.5 (10-13)	63
9	10.8 (10-11)	45
10	9.0 (8-11)	45
11	10.3 (8-12)	72

Human Smoking Puff Volumes



- Puff numbers recorded and normalised to % of cigarette smoked
- Data was grouped so that all the data sets with the same puff number could be plotted together.
- In this case, 2 smokers smoked the cigarette to 13 puffs on one occasion each

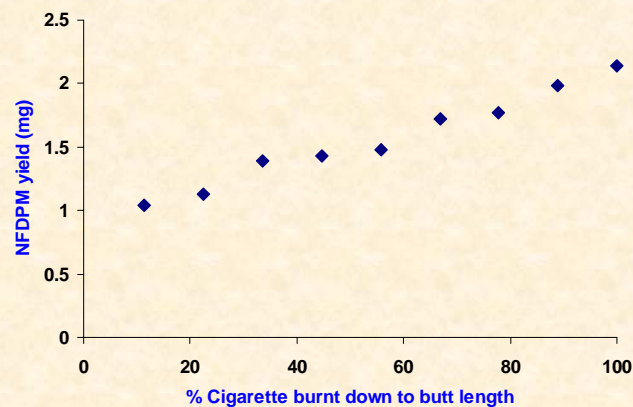
Human Smoking Puff Volumes

Puff Number	Number of Datasets	Average Puff Volume (ml)	
		First Puff	Last Puff
7	3	75	52
8	4	55	54
9	6	64	40
10	10	72	48
11	13	56	46
12	6	61	37
13	2	61	33
Overall	44	63	41

↓ Increase in puff number ↓ Decrease in puff volume under greater smoke intensity
→ Decrease in puff volume from first to last puff

- Downward trend from the first puff to the last puff - seen for all puff numbers - therefore not determined by the overall smoking intensity.
- The mean puff volume decreased from 63ml to 41ml during smoking.
- As smokers smoked more frequently, so the puff volume towards the end of the cigarette reduced accordingly
- Any reduction in puff volume will work against an increase in smoke temperature towards the end of the cigarette.

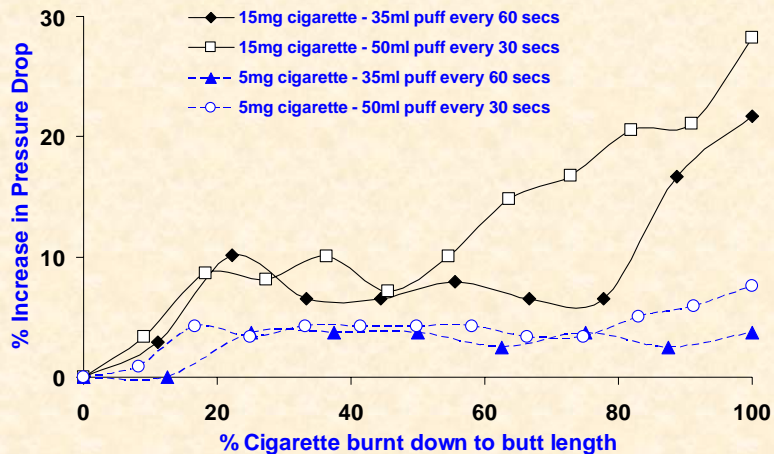
Machine smoking – Tar yield



- Data on commercial cigarette with 15mg NFDPM yield under ISO smoking.
- As the cigarette is machine smoked so the tar yield and individual smoke component yields increase per puff
- Human smokers may dislike this additional (2 fold increase in) smoke concentration and may tend to reduce their smoking intensity accordingly.

Pressure Drop (PD) changes

- Temperature / gas viscosity increases in the last few puffs increasing PD
- These effects are much less marked for ventilated products – so smokers are unlikely to voluntarily want to vent block during the later puffs and cause this effect



Conclusions

- Data show that high smoke temperatures generated in the cigarette during machine smoking with 100% vent blocking do not fit well with human smoking.
- Smokers modify their behaviour over the course of smoking the cigarette in response to changes in ease of draw, in smoke concentrations as well as to any smoke temperature effects.
- Given the evidence, a regime with 100% vent blocking of ventilated cigarettes is inappropriate for product characterisation and evaluation if any relationship to human smoking were to be made.