



**Fine Cut Tobacco:
NFDPM ("Tar")
Nicotine and Carbon
Monoxide Smoke Yields
Determined From Articles
Made From the Five Top
Selling Brands Sold
in the UK**

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**FINE CUT TOBACCO: NFDPM (“TAR”), NICOTINE AND CARBON MONOXIDE
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Summary

Department of Health commissioned Arista Laboratories Europe to acquire, manufacture and machine smoke articles for the five top selling brands of fine cut tobacco on sale in the UK.

Using ISO 15592ⁱ five blends of fine cut tobacco (covering 96.6 % of the UK market) were used to prepare “smoking articles” which were smoked and analysed.

The lack of information regarding yields of hand made cigarettes is a gap in public information. While smokers of manufactured cigarettes have some guide to the smoke yields from their purchases no such information is available to fine cut tobacco users. Calls from the public would indicate that such smokers would welcome some information to allow comparison with manufactured cigarettes.

The nicotine values across the different brands ranged between 0.79 and 1.27 mg/FCSA. They were within ± 20 % of the expected values supplied by the manufactures (except Golden Virginia). NFDPM's with a range of 11.7 to 14.3 mg/FCSA were higher than ± 20 % of the supplied values. The high yields are in part due to the variation inherent in “hand made” articles as opposed to machine made cigarettes.

It was not possible to distinguish between the different brands of tobacco, except Drum, since the smoke yields of NFDPM, nicotine and carbon monoxide were similar for each blend. Smoking of laboratory made articles results in considerable variation in smoke yields, even when the articles have been made under controlled conditions, and attention is required to reduce this in the smoking procedure adopted. Even with care variability is greater for data from laboratory produced FCSA's than that from manufactured cigarettesⁱ. Within each brand of tobacco it was noted that the variation in smoke yields was greater than that normally found within brands of machine manufactured cigarettes. This variation in yields is in line with values determined by the tobacco manufactures.

1. Introduction

International standard methods (ISO) are available for the determination of NFDPM, nicotine and carbon monoxide yields of cigarettes. These have been used extensively over the last 30 years to categorise cigarettes by yield and to enable consumer information to be printed on packets identifying the NFDPM (“Tar”) and nicotine yields under standard conditions of measurement.

It has been proposed that a “cigarette” made from fine cut tobacco (FCT) should be referred to as a “**fine cut smoking article (FCSA)**”. The word “cigarette” refers only to a tobacco rod marketed as finished product.

The original methodologyⁱⁱ called for a matrix of 4 articles to be made using two weights of tobacco and two standard papers pre-formed into tubes. The “A” paper has a porosity of 50 CORESTA units and the “B” paper of 15. The two sizes of the tubes are 5.2 mm and 7.2 mm. The tubes are filled with an accurate weight of tobacco (400 (± 10) mg or 750(± 10) mg), using

a specific making device (manufactured by EFKA Werke and based on a machine available to the public). For this study, in line with the recommended protocol (and expected pack declaration), one matrix point (the “B” paper formed into a 5.2 mm tube with 400 mg tobacco) was used. Previous studies, using the publicⁱⁱⁱ, had determined that this point is the most representative for the UK type of use.

2. Samples

Four brands of fine cut tobacco were received from the manufactures during early March 2003, due to a delay in delivery, the other brand was purchased from a local tobacconist (care was taken to ensure all packs were from the same batch). Table 1 shows the brands and share of market. These brands cover 96.6 % of the UK market according to World Tobacco issue 188 (May 2002).

Table 1: Tobacco brands, Share of UK market, Pack Size and Pack Code

Brand	Manufacturer	Percentage Share of UK market	Bulk or Retail Packs	Pack Code
Amber Leaf	Gallaher	12.5	25 gram	3103T 67
Cutters Choice	British American Tobacco	6.7	25 gram	562186 03:14
Drum	Imperial Tobacco	10.9	Bulk	216
Golden Virginia	Imperial Tobacco	48.7	Bulk	GV
Old Holborn	Gallaher	17.8	25 gram	3103T 49

The Imperial Tobacco Limited (ITL) samples arrived in bulk (tobacco bags containing 500g each). The other three brands were individually packed in 25g units. ITL and Gallaher supplied their brands. The Cutters Choice was bought as a 10 x 25 gram box (250 grams only) to ensure all packs were from the same batch.

Of the three brands that were packaged in 25g units all displayed health warnings. The Amber Leaf being the clearest with approximately 1/3 of the front and back wrapper being a black outlined white box with large black lettering. The Old Holborn being the least clear being written in gold lettering on a blue background (this brand stated that the health warning was an “Irish Government Warning” and “UK Duty Paid” did not appear on the wrapper. The Old Holborn samples as received were therefore not intended for the UK market, but it is assumed that the same blend is supplied to the UK market¹. There were no yield declarations.

¹ This was later confirmed as correct by the manufacturer

3. Fine Cut Smoking Article Preparation and Smoking

The tobacco was conditioned for 3 days before use. About a quarter of the bulk tobacco samples were placed in Perspex containers and of the individually packaged tobacco 5 packs of each brand were opened. Conditions were set at 75 % RH (± 3 %) and 22°C (± 1 °C).

While the articles were being manufactured smaller amounts of the tobacco were kept in condition using a large desiccator containing a saturated solution of Sodium Chloride (salt) which holds the humidity of the desiccator at 75 % RH with the room temperature being controlled at 22°C (± 2 °C)

Each blend had different handling characteristics. The Amber Leaf having a “sticky” feel that caused problems with the making device. This kept holding the tobacco in the machine and not inserting it in the wrapper. Cleaning the filling machine frequently when producing this brand of FCSA helped with this problem. The easiest tobaccos to prepare FCSA from (i.e. the least “gummy”) were Drum and Cutters Choice.

The FCSA’s were all manufactured with the 5.2 mm internal diameter paper “B”. The paper type “B” has a paper porosity of 15 cm³/min/cm² at a pressure of 1 kP.

The articles were made as described in ISO 15592-3ⁱ using the device manufactured by EFKA Werke. An illustrated pamphlet (*Making of Fine Cut Smoking Articles*) shows how this was achieved. It was produced for the CORESTA collaborative study undertaken in 2001.

Small portions of tobacco were removed from the conditioned atmosphere just prior to manufacture. The articles were manufactured in sets of 32 to 42 per tobacco type (depending on which smoking day they were intended for, as different numbers of FCSA were required for each run). Each individual article was checked weighed at the time of manufacture to ensure it was within ± 10 mg of the specified weight of 400 mg (plus paper wrap). The prepared articles were conditioned for between 3 and 5 days at 75 % RH (± 3 %) 22°C (± 1 °C). Each set was divided into a subset of 5 articles that were weighed after conditioning, just prior to smoking this being the recorded weight for the subset. The FCSA’s for the fourth run (called “run 25”) were not weighed prior to smoking. To minimise operator variability as much as possible, two people manufactured, one person butt marked the FCSA’s and two people undertook the smoking.

4. Method

Twenty determinations of each brand of fine cut tobacco were been made. Each determination involved smoking five FCSA’s. Five different types of tobacco were analysed at the selected matrix point of 5.2 mm paper “B.”

The six smoking runs were carried out over 3 days. As Cutters Choice was late in arriving the majority of Golden Virginia FCSA’s were smoked on day one and the majority of Cutters Choice smoked on day 3 to allow the articles time to condition.

Each run consisted of 16 to 17 channels of FCSA’s the remaining channels in each run comprising of monitor cigarettes (CORESTA CM 3). These test pieces were produced under specially strict and controlled manufacturing conditions. They were smoked to monitor the stability of the analytical processes when using the smoking machine.

The FCSA’s were smoked to the standard butt lengthⁱ of 27 mm with an insertion depth of 13 mm, using a 20 channel linear Cerulean SM400 smoking machine with an NDIR detector attached for carbon monoxide analysis. The water was analysed by TCD and nicotine by FID using an Agilent GC 6890 gas chromatograph.

5. Results and Discussion

A summary of results can be found in Table 2 below. Full data is given in section 6. Each FCSA was weighed after manufacture to be 420mg ± 10mg (this allows for the weight of the paper wrapper). The mean of the Amber Leaf, Golden Virginia and Old Holborn FCSA were outside this range after conditioning. The other brands were within limits. The variation in weights after conditioning may show the need of further conditioning for the tobacco to allow it to reach equilibrium prior to the manufacturing of FCSA.

Table 2: Summary of Mean Results for the Five Brands of Fine Cut Tobacco

Sample	Weight of single FCSA	Weight of Tobacco Smoked	NFDPM	Nicotine	CO Yield	TPM	Puffs	TN Ratio
	(mg)	(mg)						
Amber Leaf (CV)	399	245	12.7 (8.9)	1.19 (10.6)	6.73 (7.1)	17.0	7.9	10.6
Cutters Choice (CV)	413	254	13.8 (13.3)	1.02 (10.9)	7.01 (11.8)	18.2	7.4	13.3
Drum (CV)	430	264	11.7 (15.8)	0.79 (18.3)	6.55 (9.3)	15.2	7.4	15.3
Golden Virginia (CV)	405	249	14.3 (8.0)	1.27 (9.3)	7.49 (9.4)	19.3	8.6	11.2
Old Holborn (CV)	407	250	13.1 (14.2)	1.00 (11.9)	6.98 (8.4)	17.9	7.9	13.0

Results for the 20 channels of CM3 Monitor cigarettes smoked showed good agreement with the expected ranges. Table 3 shows the mean data for CM 3, the full results can be found in Table 10. The CM 3 data show that the runs were smoked correctly.

Table 3: Summary of Mean Results for CM 3 Monitor Cigarette

Sample	NFDPM	Nicotine	CO Yield	TPM	Water	Puffs	TN Ratio
	← mg/cig →						
Monitor – CM 3	16.41	1.25	14.70	20.04	2.38	8.8	13.13

There is a much wider variation within a single blend than is expected from machine manufactured cigarettes. There are several reasons why the CV's for the run data were higher than the CORESTA collaborative study^{iv} or previous work using Golden Virginia.^v Industry sources have indicated that ±2 mg/FCSA difference in NFDPM within one batch is expected. It is also the first set of data we have for four of the brands.

The two brands (Golden Virginia and Cutters Choice) that had the majority of their samples smoked on a single day have lower CV's for NFDPM and nicotine. Drum that has the highest weight of tobacco also has the highest CV for NFDPM and nicotine. As stated previously

there is variation inherent to an “hand made” article as opposed to machine made cigarette. The manufacture and smoking of FCSA depends on the skill of the operatives.

While the CO yields, for Golden Virginia, are lower than found previously, the NFDPM and nicotine yields are higher (see Appendix 2). This may in part be due to a variation in paper porosity supplied by the manufacturer.

Table 4: Manufacturers Published Values for Fine Cut Tobacco

Blends	NFDPM 5.2 “B” (mg/FCSA)	Range (\pm 20%)	Nicotine 5.2 “B” (mg/FCSA)	Range (\pm 20%)
Amber Leaf	11	8.8 – 13.2	1.0	0.80 - 1.20
Cutters Choice	11	8.8 – 13.2	1.0	0.80 - 1.20
Drum	10	8.0 – 12.0	0.7	0.56 - 0.84
Golden Virginia	11	8.8 – 13.2	1.0	0.80 - 1.20
Old Holborn	11	8.8 – 13.2	0.8	0.64 – 0.96

There are some differences between the different blends of tobacco. Drum, with the heaviest weight of smoked tobacco gave the lowest yields for all three main analytes. Golden Virginia gave the highest. As can be seen from Table 4 NFDPM is outside the expected range for Cutters Choice and Golden Virginia tobaccos, but the nicotine yields are within the expected range (except for the Golden Virginia).

Higher levels of water were found than would be expected in cigarettes, partly due to the higher humidity at which they are conditioned. Water values for this project even though they are higher than for cigarettes, are about 2 mg/FCSA less than that found in Golden Virginia previously. As the TPM and puffs were very similar to those determined in previous work the lower water does raise the NFDPM. The CM 3 results were as expected so there is no obvious reason for the change in measured water as the FCSA’s were smoked in a 60 % RH (\pm 5 %) 22°C (\pm 2°C) conditioned atmosphere as before.

The mean smoke yield data for the 5.2 mm “B” paper determined for the CORESTA collaborative study undertaken in 2001 is given in the Appendices.

ⁱ ISO 15592-3 Fine-cut tobacco and smoking articles made from it – Methods of sampling, conditioning and analysis – Part 3: Determination of total particulate matter of smoking articles using a routine analytical smoking machine, preparation for the determination of water and nicotine, and calculation of nicotine-free dry particulate matter

ⁱⁱ CORESTA Bulletin, 1999-2000, Roll-Your-Own Report

ⁱⁱⁱ KG Darrall & JA Figgins, Tobacco Control 7, (2), 168, 1998

^{iv} Determination of NFDPM, Nicotine and Carbon Monoxide Yields from Mainstream Smoke of Fine cut Tobacco (LGC report FN40/M25/01)

^v Fine Cut Tobacco: Results using the Proposed ISO Standard for Determination of NFDPM, Nicotine and Carbon Monoxide Smoke Yields. (LGC report FN40/M08/01 and FN40/M09/01)

6. TNCO Yields for FCSA's

Table 5: Amber Leaf

Run	Chan	Mean Weight of FCSA	NFDPM	Nicotine	CO Yield	TPM	Water	Puffs	CO % (Corrected)
		(mg)							
		<----- mg/FCSA ----->							
24	1	391.3	11.63	1.13	6.24	15.18	2.42	7.6	1.99
23	2	400.8	11.40	1.12	6.06	14.88	2.36	8.0	1.86
22	3	396.8	12.89	1.24	6.35	17.18	3.05	8.4	1.87
27	4	402.9	13.63	1.30	7.66	18.64	3.71	7.2	2.56
26	5	404.3	13.04	0.84	7.14	16.88	3.00	7.8	2.21
25	6	*	13.36	1.30	7.50	18.42	3.76	7.9	2.29
24	7	392.9	12.78	1.30	6.93	18.04	3.96	7.4	2.27
23	8	402.5	10.30	1.00	5.80	13.12	1.82	8.0	1.78
22	9	407.6	12.40	1.19	6.60	16.10	2.51	7.6	2.14
27	10	402.4	13.44	1.28	6.55	17.58	2.86	8.2	1.92
26	11	399.2	12.70	1.16	6.65	16.32	2.46	7.6	2.10
25	12	*	13.43	1.30	7.01	18.26	3.53	8.0	2.12
24	13	388.4	13.01	1.27	6.44	17.46	3.18	8.8	1.78
23	14	403.5	10.24	0.99	6.39	13.68	2.45	7.6	2.07
22	15	404.4	13.87	1.31	7.14	18.92	3.74	8.2	2.15
27	16	403.7	13.38	1.30	7.24	18.36	3.68	7.8	2.25
26	17	397.3	14.69	1.24	6.55	19.44	3.51	8.5	1.85
25	18	*	12.76	1.19	7.04	17.04	3.09	7.1	2.41
24	19	393.7	11.83	1.21	6.41	15.80	2.76	8.0	1.95
23	20	395.0	12.30	1.20	6.83	16.68	3.18	8.4	2.00
	Mean	399.2	12.65	1.19	6.73	16.90	3.05	7.9	2.08
	SD	5.46	1.12	0.13	0.48	1.72	0.59	0.4	0.21
	CV	1.37	8.89	10.57	7.13	10.16	19.35	5.5	10.23

*The FCSA were not weighed before smoking for Run 25

Table 6: Cutters Choice

Run	Chan	Mean Weight of FCSA	NFDPM	Nicotine	CO Yield	TPM	Water	Puffs	CO % (Corrected)
		(mg)							
		<----- mg/FCSA ----->							
26	1	414.7	13.58	1.04	6.98	17.66	3.04	7.3	2.30
27	2	406.6	13.03	0.99	6.39	16.66	2.64	7.5	2.06
25	2	*	11.99	0.94	5.35	15.64	2.71	7.5	1.73
24	3	407.4	12.49	1.01	6.14	16.46	2.96	7.4	2.02
26	3	410.0	13.81	1.01	7.66	18.30	3.48	6.8	2.71
27	6	410.0	10.89	0.76	7.34	13.64	1.99	6.9	2.56
26	7	426.8	17.44	1.16	8.14	23.50	4.90	7.4	2.65
27	8	411.0	14.45	1.08	7.32	19.00	3.47	7.2	2.45
25	8	*	13.30	0.98	6.56	17.32	3.04	7.2	2.21
24	9	400.4	11.52	0.94	5.90	15.12	2.66	7.2	1.99
26	9	414.2	15.71	1.19	7.57	21.80	4.90	8.2	2.22
27	12	416.7	13.13	1.01	7.05	17.22	3.08	7.4	2.29
26	13	419.7	16.57	1.21	8.69	22.84	5.06	7.4	2.83
27	14	408.3	12.83	0.95	6.92	16.68	2.90	7.2	2.32
25	14	*	12.27	0.93	6.31	16.08	2.88	6.8	2.25
24	15	395.0	13.44	0.99	6.38	17.70	3.27	7.2	2.14
26	15	429.8	14.85	1.04	7.30	19.62	3.73	7.3	2.40
27	18	415.6	13.07	0.96	6.99	16.94	2.91	8.7	1.94
26	19	422.5	17.52	1.24	8.32	23.60	4.84	7.6	2.64
25	20	*	13.53	1.04	6.85	18.14	3.57	7.8	2.12
	Mean	413.1	13.77	1.02	7.01	18.20	3.40	7.4	2.29
	SD	9.06	1.83	0.11	0.83	2.78	0.87	0.4	0.29
	CV	2.19	13.32	10.94	11.85	15.30	25.59	6.0	12.46

*The FCSA were not weighed before smoking for Run 25

Table 7: Drum

Run	Chan	Mean Weight of FCSA	NFDPM	Nicotine	CO Yield	TPM	Water	Puffs	CO % (Corrected)
		(mg)							
25	1	*	10.36	0.77	5.89	13.18	2.05	7.4	1.93
24	2	437.0	9.95	0.64	6.34	13.12	2.53	7.4	2.08
23	3	427.3	10.68	0.77	6.49	14.28	2.83	7.2	2.22
22	4	431.3	11.64	0.73	6.49	14.66	2.29	7.2	2.22
27	5	428.5	13.88	1.05	6.56	18.32	3.39	7.2	2.19
26	6	431.8	13.25	1.26	7.90	18.02	3.51	7.1	2.67
25	7	*	10.95	0.76	6.29	14.44	2.73	7.6	2.00
24	8	428.0	12.58	0.83	7.14	16.72	3.31	7.6	2.28
23	9	430.6	12.45	0.85	7.70	16.66	3.36	7.4	2.56
22	10	425.4	10.71	0.73	5.97	13.16	1.72	7.4	1.99
27	11	428.0	15.38	0.75	6.02	18.46	2.33	7.2	2.01
26	12	428.6	13.91	0.92	7.25	18.90	4.07	7.4	2.36
25	13	*	9.57	0.69	5.66	12.26	2.00	7.6	1.80
24	14	434.0	9.77	0.65	6.47	12.82	2.40	6.7	2.35
23	15	429.8	11.66	0.78	6.94	15.74	3.30	7.6	2.26
22	16	439.3	9.70	0.67	5.66	12.52	2.15	8.1	1.71
27	17	426.0	10.28	0.69	6.49	12.62	1.65	7.0	2.23
26	18	429.9	11.96	0.76	6.82	15.04	2.32	6.9	2.37
25	19	*	10.38	0.75	6.28	13.32	2.19	7.4	2.05
24	20	429.1	15.61	0.78	6.58	18.84	2.45	8.2	1.95
	Mean	430.3	11.73	0.79	6.55	15.15	2.63	7.4	2.16
	SD	3.77	1.86	0.15	0.61	2.36	0.66	0.4	0.24
	CV	0.88	15.85	18.34	9.30	15.58	25.08	4.8	11.14

*The FCSA were not weighed before smoking for Run 25

Table 8: Golden Virginia

Run	Chan	Mean Weight of FCSA	NFDPM	Nicotine	CO Yield	TPM	Water	Puffs	CO % (Corrected)
		(mg)							
22	1	414.2	15.03	1.28	8.01	20.14	3.83	8.9	2.23
25	4	*	14.29	1.35	7.22	19.64	4.00	8.7	2.00
23	4	405.0	15.45	1.41	8.60	21.62	4.76	8.6	2.46
24	5	408.2	14.35	1.31	7.48	18.98	3.32	8.4	2.16
22	5	421.8	15.09	1.27	8.16	20.44	4.08	7.6	2.65
23	6	402.0	12.81	1.20	6.75	17.18	3.17	8.9	1.87
22	7	399.7	12.79	1.16	6.84	16.44	2.49	7.7	2.19
23	10	397.3	13.54	1.37	7.18	18.98	4.07	9.2	1.92
25	10	*	15.15	1.38	7.86	20.86	4.33	8.6	2.21
22	11	403.3	11.79	1.00	6.07	15.28	2.49	8.0	1.87
24	11	409.8	14.52	1.20	6.91	19.44	3.72	9.4	1.79
23	12	402.4	15.37	1.32	8.51	21.06	4.37	8.6	2.44
22	13	406.2	12.92	1.09	7.19	17.62	3.61	8.5	2.08
25	16	*	13.69	1.31	6.99	18.42	3.42	8.6	1.97
23	16	396.7	15.79	1.41	8.48	22.66	5.46	8.2	2.55
24	17	404.7	14.18	1.14	7.00	18.46	3.14	9.2	1.85
22	17	412.0	15.11	1.33	7.88	20.80	4.36	8.1	2.39
23	18	399.2	13.73	1.21	6.94	18.44	3.50	8.3	2.06
22	19	393.1	13.53	1.23	7.36	18.24	3.48	8.4	2.16
27	20	411.3	16.07	1.47	8.32	21.40	3.86	9.6	2.09
	Mean	405.1	14.26	1.27	7.49	19.31	3.77	8.6	2.15
	SD	7.24	1.15	0.12	0.70	1.87	0.71	0.5	0.25
	CV	1.79	8.04	9.31	9.36	9.67	18.89	6.2	11.51

*The FCSA were not weighed before smoking for Run 25

Table 9: Old Holborn

Run	Chan	Mean Weight of FCSA	NFDPM	Nicotine	CO Yield	TPM	Water	Puffs	CO % (Corrected)
		(mg)							
23	1	408.7	12.16	0.97	6.83	17.16	4.03	8.8	1.91
22	2	414.4	12.70	0.98	6.92	17.18	3.50	7.6	2.26
27	3	405.0	13.90	1.11	7.63	19.70	4.69	8.4	2.19
26	4	406.5	15.00	1.20	7.88	21.04	4.84	8.2	2.32
25	5	*	12.73	1.02	7.23	17.28	3.53	7.8	2.24
24	6	399.2	13.58	1.00	7.38	18.80	4.22	7.4	2.42
23	7	410.3	10.95	0.83	6.75	15.14	3.36	7.2	2.31
22	8	411.0	12.55	0.94	7.05	16.96	3.47	6.8	2.56
27	9	397.2	14.59	1.16	7.16	20.90	5.15	8.3	2.08
26	10	403.8	12.95	1.08	6.68	18.16	4.13	8.2	1.96
25	11	*	12.32	1.00	6.65	16.76	3.44	7.8	2.05
24	12	402.1	13.80	1.04	7.58	18.94	4.10	7.6	2.42
23	13	403.3	12.76	0.95	7.85	18.12	4.41	6.6	2.93
22	14	402.9	10.10	0.78	5.61	13.32	2.44	8.4	1.65
27	15	404.5	18.48	1.12	6.98	23.62	4.02	8.6	1.96
26	16	408.1	14.13	1.16	7.50	19.42	4.13	7.7	2.35
25	17	*	11.75	1.02	6.13	16.02	3.25	8.4	1.77
24	18	418.1	15.00	0.89	6.23	18.78	2.89	8.0	1.88
23	19	407.6	11.40	0.86	7.03	15.68	3.42	8.3	2.09
22	20	419.5	11.02	0.84	6.51	14.32	2.46	8.3	1.93
	Mean	407.2	13.09	1.00	6.98	17.87	3.77	7.9	2.16
	SD	6.10	1.86	0.12	0.59	2.44	0.73	0.6	0.30
	CV	1.50	14.20	11.91	8.41	13.67	19.37	7.4	13.82

*The FCSA were not weighed before smoking for Run 25

Table 10: Monitor CM 3

Run	Chan	NFDPM	Nicotine	CO Yield	TPM	Water	Puffs	CO % (Corrected)
27	1	16.54	1.25	14.65	20.26	2.47	8.9	3.95
26	2	14.44	1.13	13.30	17.32	1.75	8.0	4.02
25	3	16.01	1.25	14.49	19.72	2.46	8.7	4.04
24	4	15.67	1.23	14.23	19.16	2.26	8.9	3.89
23	5	16.33	1.26	14.55	20.02	2.43	9.1	3.94
22	6	16.62	1.23	14.68	20.06	2.21	8.9	4.09
27	7	16.33	1.22	14.43	19.76	2.21	8.6	4.02
26	8	17.31	1.33	14.95	21.20	2.56	8.8	4.11
25	9	16.70	1.31	15.02	20.56	2.55	9.0	4.04
24	10	16.66	1.24	14.54	20.34	2.44	8.8	3.99
23	11	17.31	1.31	15.09	21.30	2.68	9.0	4.13
22	12	16.92	1.27	15.09	20.74	2.55	9.1	4.11
27	13	16.51	1.24	14.94	20.20	2.45	8.8	4.08
26	14	16.09	1.23	14.25	19.48	2.16	8.6	3.99
25	15	16.27	1.25	14.87	19.96	2.44	8.5	4.25
24	16	15.55	1.19	14.18	18.96	2.22	8.8	3.89
23	17	16.80	1.25	15.42	20.48	2.43	9.1	4.15
22	18	16.70	1.24	14.97	20.22	2.28	9.0	4.09
27	19	17.13	1.29	15.24	21.08	2.66	9.1	4.03
26	20	16.37	1.26	15.06	19.96	2.33	9.0	4.03
	Mean	16.41	1.25	14.70	20.04	2.38	8.8	4.04
	SD	0.66	0.04	0.48	0.89	0.21	0.3	0.09
	CV	4.03	3.49	3.27	4.44	8.88	3.0	2.20

7. Appendices

Appendix 1 Selected abbreviations and terms used in this report

Term/Definition	Meaning
Channel	The channel of the smoking machine that the cigarette was smoked on
CO	Carbon Monoxide
CO %	Percentage volume of carbon monoxide in the total volume of mainstream smoke corrected for any clearing puffs
FCSA	Fine Cut Smoking Article – The “cigarette” made from Fine Cut Tobacco
FCT	Fine Cut Tobacco – Tobacco produced to be used by consumers for making their own smoking articles (previously known as “hand rolling tobacco”)
FID	Flame Ionization Detector
°C	Degree Celsius
CORESTA units	Air permeability (at a pressure of 1 kP) - (units in cm ³ /min/cm ²) of paper wrappers
mg	Milligram
L	Litre
mL	Millilitre
mm	Millimetre
NFDPM	Nicotine Free Dry Particulate Matter, commonly known as “Tar”
Overwrap	The wrapper applied to the mouth end of the cigarette
Run	The smoking run that the cigarette was smoked in (Arista code)
TPM	Total Particulate Matter
TCD	Thermal Conductivity Detector
Wrapper	Material specially prepared and supplied in a form suitable for enclosing fine cut tobacco so as to produce a fine cut smoking article
Yield	The concentration of analyte measured in the smoke (normally per FCSA)
cig ⁻¹	per cigarette

Appendix 2: Previous Work on FCSA

Yields from Golden Virginia Tobacco Smoked in 2001 using Paper “B” 5.2 mm

Batch	N° of Tests		NFDPM	Nicotine	CO Yield	TPM	Water	Puffs	T/N Ratio
			← mg/cig →						
1	11	Mean	12.89	1.05	10.40	18.83	4.89	8.16	12.32
		SD	0.85	0.07	0.69	1.39	0.53	0.30	0.44
		CV	6.61	6.67	6.59	7.38	10.8	3.65	3.59
2	6	Mean	12.96	1.00	9.74	18.98	5.02	8.35	13.03
		SD	0.67	0.05	0.80	1.31	0.70	0.44	0.53
		CV	5.17	4.53	8.17	6.89	14.0	5.23	4.06
3	5	Mean	13.77	1.10	9.74	19.43	4.56	8.08	12.55
		SD	1.20	0.09	0.75	1.77	0.54	0.50	0.57
		CV	8.70	8.28	7.87	9.12	11.8	6.15	4.53
All	22	Mean	13.11	1.04	10.01	19.01	4.85	8.20	12.57
		SD	0.93	0.08	0.81	1.41	0.58	0.38	0.56
		CV	7.08	7.27	8.06	7.41	11.9	4.65	4.47

(Extract from a previous report - FN40/M09/01)

Yields for the CORESTA Collaborative Study 2001 using Paper “B” 5.2 mm

Tobacco Type		Weight of FCSA (mg)	NFDPM	Nicotine	CO Yield	TPM	Puffs	T/N Ratio
			← mg/FCSA →					
Firecured Blend	mean	433.1	13.26	1.33	9.74	18.65	5.84	10.00
	SD	0.05	0.76	0.09	0.51	1.28	0.31	0.40
	CV	0.50	5.77	6.67	5.29	6.86	5.28	4.03
CORESTA Values			12.1	1.25				
Firecured/Fluecured Blend	mean	428.8	11.29	0.79	8.24	14.96	6.05	14.27
	SD	0.03	1.10	0.08	0.86	1.75	0.36	0.30
	CV	0.31	9.75	10.01	10.47	11.68	6.03	2.11
CORESTA Values			10.7	0.82				
Fluecured/Aircured Blend	mean	442.7	10.32	0.64	7.28	14.15	6.72	16.11
	SD	0.43	0.67	0.03	0.66	1.25	0.56	0.61
	CV	4.42	6.53	5.24	9.10	8.87	8.40	3.80
CORESTA Values			10.1	0.65				

The CORESTA values are taken from ISO 15592-3¹. They are some of the results obtained from an inter-laboratory collaborative study.