



Smoke Analysis Sub-Group

Technical Report

**2022 Collaborative Study for HCN
in Mainstream Cigarette Smoke**

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1. Summary

As a follow-up to the 2021 proficiency study, the CORESTA Smoke Analysis Sub-Group (SA SG) conducted a collaborative study (CS) in an effort to publish a CORESTA Recommended Method (CRM) on the determination of hydrogen cyanide (HCN) in mainstream cigarette smoke that accommodates the total HCN-only pad and pad plus impinger reporting requirements.

The CS reported here was conducted using 2R5F and 1R6F reference cigarettes and CM9 monitor test pieces and 4 commercial cigarettes smoked using ISO non-intense (ISO 3308) and intense (ISO 20778) regimes. The cigarettes included American blend, American blend with charcoal filter, and Virginia blend. ISO 3308 nominal tar values ranged from 1 mg/cig to 16 mg/cig. Eighteen participating laboratories provided 22 data sets across both method sub-types (“Pad+Imp” and “Pad+Pad”) and linear and rotary smoking machines.

Across the sample types and smoking regimes employed, the TPM ranged from approximately 2 to 50 mg/cig and the HCN ranged from 13 to 400 µg/cig.

Statistical analysis was carried out following the ISO standard 5725 to generate repeatability (r) and reproducibility (R) data on a combined data set (i.e. linear and rotary smoking). Under ISO 3308 regime, the maximum of r (%) and R (%) from data sets with exclusion of outliers are 19.98 % and 32.30 %, respectively. Under ISO 20778 regime, the values are 11.27 % and 25.62 %, respectively. The test results of this study are acceptable.

No statistically significant differences are observed between the measured results with the “Pad+Pad” trapping system and the “Pad+Imp” trapping system under both ISO 3308 and ISO 20778 smoking regimes.

Results reported herein support publication of a robust CORESTA Recommended Method for the determination of hydrogen cyanide in mainstream smoke by continuous flow analysis with “Pad+Imp” or “Pad+Pad” (treated plus blank pad) as acceptable alternative trapping methods.

2. Introduction

In the SA Sub-Group virtual meeting held on May 10, 2022, the Sub-Group decided to perform a further study on the method for the determination of HCN in mainstream cigarette smoke based on a study in 2021. Jun Zhou and Rana Tayyarah were confirmed to work as coordinators to lead the study. The study protocol, the drafted CRM, a template and a video for the introduction of the trapping system with the Pad treated with NaOH solution plus blank pad were distributed in July 2022 and participants were called for. Seven cigarette samples (CM 9, KR 1R6F, KR 2R5F and 4 commercial cigarettes) covering a wide range of blends and cigarette design constructions were employed in the study. Two smoke trapping systems, considered as method sub-types, (Pad plus Impinger and Pad treated with NaOH solution plus blank pad) were optional in the study. Five sets of test data were received for the trapping system with Pad plus Impinger and 17 sets of test data were received for the trapping system with Pad treated with NaOH solution plus blank pad. Most of the laboratories selected 600 nm as detection wavelength, only two of them used 570 nm and 630 nm, respectively. Nineteen laboratories confirmed to participate in the study. Although a lot of difficulties were met in sample shipping, eighteen laboratories provided test data and four of them provided two sets of data, either for both method sub-types or for both linear and rotary smoking machines. Jun Zhou and Rana Tayyarah drafted the study protocol, the CRM and the template. Dr. Xingyu Liu was responsible for the development of the final CRM and commercial cigarettes sample preparation and distribution. Dr. Guogong Du was responsible for data statistical analysis.

No statistically significant differences are observed between the measured results with the “Pad+Pad” and “Pad+Imp” method sub-types under both ISO 3308 and ISO 20778 smoking regimes. Though the labs were not all running the same method sub-type, the repeatability and reproducibility suggested that the test results were within the range that would likely be deemed acceptable.

3. Organisation

3.1 Participants

The laboratories (labs) that participated in the 2022 study are listed in Table 1. To ensure anonymity of the results, each laboratory was given a unique laboratory code that was used for the reporting of the data and was shared with each laboratory separately. Laboratory codes were different from the order of the participating laboratories in Table 1.

Table 1. Participating laboratories in 2022 Joint Experiment

Participants
BATB Regulatory Analysis Laboratory
Beijing Cigarette Factory Company, Ltd, Shanghai Tobacco Group
Beijing Tobacco Quality Supervision and Inspection Station
China National Tobacco Quality Supervision and Test Center
China Tobacco Anhui Industrial Co., Ltd.
China Tobacco Chongqing Industrial Co., Ltd.
China Tobacco Fujian Industrial Co., Ltd.
China Tobacco Gansu Tobacco Industrial Co., Ltd.
China Tobacco Guangxi Industrial Co., Ltd.
China Tobacco Guizhou Industrial Co., Ltd.
China Tobacco Henan Industrial Co., Ltd.
China Tobacco Jiangxi Industrial Co., Ltd.
China Tobacco Sichuan Industrial Co., Ltd.
China Tobacco Zhejiang Industrial Co., Ltd.
Global Laboratory Services
KT&G Research Institute
MP C.I.T. Montepaz S.A.
Yunnan Tobacco Quality Supervision and Inspection Station

3.2 Protocol

The Study Protocol is described briefly below and the full text is provided in **Appendix A**. The analytical method can be found in **Appendix B**.

Seven samples were employed for the 2022 study and the details are listed in Table 2.

Table 2. Cigarette samples included in the Joint Experiment

Sample	Description	ISO 3308 'tar' level (mg/cig)
KR 2R5F	American Blend	1
Sample 1	American blend – charcoal filter	3
Sample 2	American blend – charcoal filter	5
KR 1R6F	American Blend	8
Sample 3	Virginia Blend	8
Sample 4	Virginia Blend	11
CM9	Virginia Blend	16

4. Data – Summary Descriptive Analysis

4.1 Raw Data

There are 18 labs that provided the test data of HCN in mainstream cigarette smoke, both under ISO 3308 and ISO 20778 smoking regimes. Specifically, labs 14 and 16 provided the test data with both “Pad+Pad” and “Pad+Imp” trapping systems. Labs 8 and 17 provided the test data with both linear and rotary smoking machines. Together, there were 22 sets of test data, wherein 17 data sets were from the “Pad+Pad” trapping system, five data sets were from the “Pad+Imp” trapping system. Raw data are presented in summarized form in **Appendix C**. Raw data plots demonstrating the spread of the data of each participating laboratory are summarized in **Appendix D**. At this stage, no outlier statistics were applied. The details of the method can be found in **Appendix E**. The complete raw data can be found in **Appendix F**. In order to establish the difference between trapping systems, we denote results including all trapping systems with “Overall”.

4.2 Data Descriptive Analysis

The mean HCN yields and standard deviation (Stdev) of the seven samples are summarized in Table 3 for ISO 3308 smoking regime and in Table 4 for ISO 20778 smoking regime, respectively. The RSD (%) from the “Pad+Pad” is lower than that from the “Pad+Imp” for all samples except for sample 2 under ISO 20778 regime.

Table 3. Mean HCN ($\mu\text{g}/\text{cig}$) yields in mainstream smoke under ISO 3308 smoking regime

	Overall			Pad+Pad			Pad+Imp		
	Mean	Stdev	RSD(%)	Mean	Stdev	RSD(%)	Mean	Stdev	RSD(%)
CM9	139,34	9,29	6,67	140,74	8,66	6,15	134,84	10,1	7,49
KR 1R6F	95,67	5,91	6,18	96,41	5,52	5,73	93,97	8,35	8,89
KR 2R5F	12,82	1,44	11,27	12,95	1,38	10,66	13,81	3,02	21,83
Sample 1	26,96	2,78	10,32	26,41	2,43	9,21	29,11	3,08	10,59
Sample 2	53,54	4,03	7,53	52,98	4,02	7,58	59,82	6,68	11,17
Sample 3	83,50	6,90	8,27	84,09	6,97	8,29	81,83	8,00	9,78
Sample 4	103,54	6,00	5,79	103,95	6,32	6,08	95,63	11,14	11,65

Table 4. Mean HCN ($\mu\text{g}/\text{cig}$) yields in mainstream smoke under ISO 20778 smoking regime

	Overall			Pad+Pad			Pad+Imp		
	Mean	Stdev	RSD(%)	Mean	Stdev	RSD(%)	Mean	Stdev	RSD(%)
CM9	302,70	17,95	5,93	305,63	16,43	5,38	319,12	40,27	12,62
KR 1R6F	394,90	35,18	8,91	399,01	31,30	7,85	402,66	35,26	8,76
KR 2R5F	377,04	19,31	5,12	371,43	27,15	7,31	362,74	44,46	12,26
Sample 1	324,66	28,28	8,71	327,29	26,60	8,13	316,93	35,32	11,14
Sample 2	337,91	29,68	8,78	338,69	31,24	9,22	334,67	22,49	6,72
Sample 3	265,71	22,55	8,49	269,24	21,48	7,98	259,32	31,29	12,07
Sample 4	248,68	11,75	4,73	245,89	16,08	6,54	233,99	23,52	10,05

4.3 Comparison of Mean Smoke Yields of HCN between Different Trapping Systems

As shown in Figure 1 and Figure 2, the mean smoke yields of HCN from the “Pad+Pad” trapping system are very close to that from the “Pad+Imp” trapping system under both ISO 3308 and ISO 20778 smoking regimes. The paired *t*-test was carried out to compare mean smoke yields of HCN achieved by the two trapping systems. No statistically significant differences were observed between the data from the “Pad+Pad” and “Pad+Imp” trapping systems under both ISO 3308 ($p=0.555$) and ISO 20778 ($p=0.304$) smoking regimes.

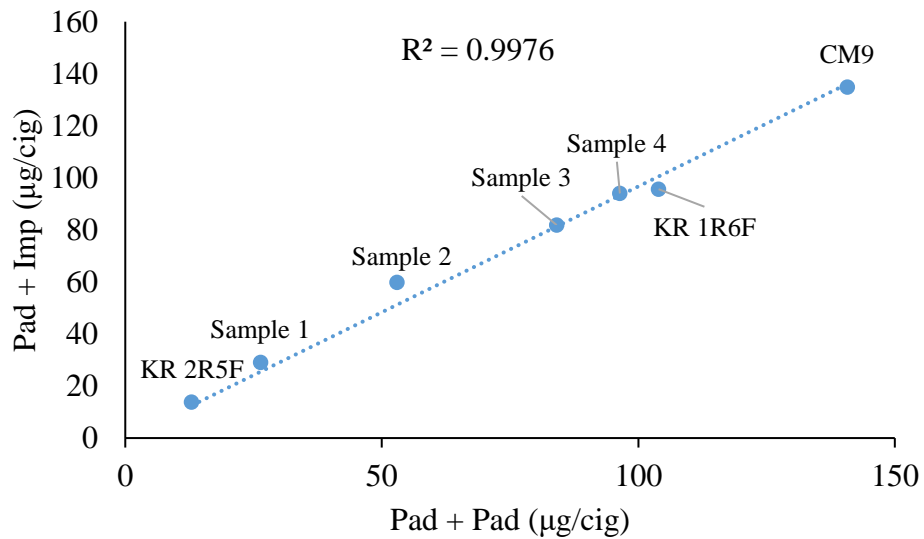


Figure 1. The scatter plot of mean smoke yields of HCN between “Pad+Pad” and “Pad+Imp” trapping systems under ISO 3308 smoking regime

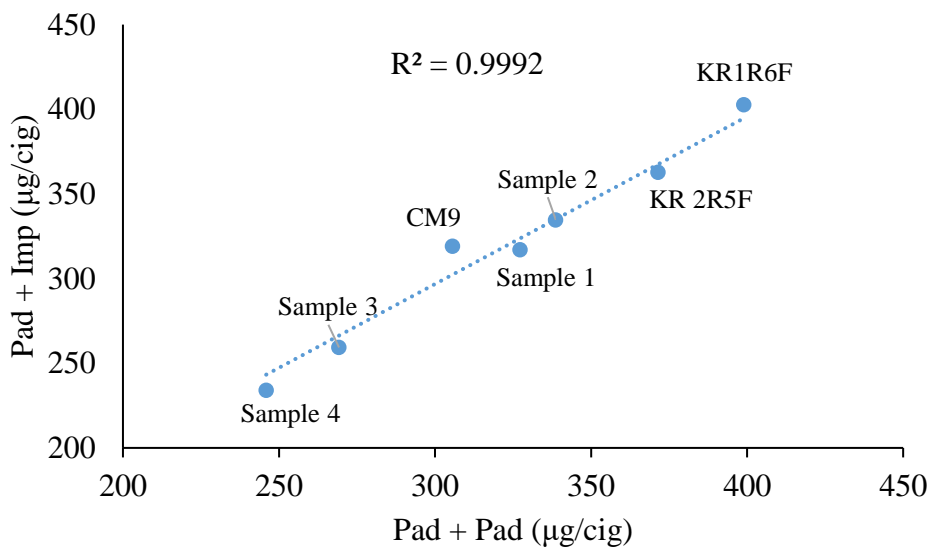


Figure 2. The scatter plot of mean smoke yields of HCN between “Pad+Pad” and “Pad+Imp” trapping systems under ISO 20778 smoking regime

5. Data – Statistical Analysis

5.1 Outliers Results

Following the steps of IUPAC^[1], the outlier detection was done by the Grubbs and Cochran methods. The method consists of sequential applications of the Cochran's and Grubbs' tests until no further outliers are detected or until a drop of more than 22,2 % (ca. 2/9) of the total data sets would occur^[2], and the procedure can be found from **Appendix G**. Because the number of data sets (labs) is not more than five using “Pad + Imp” trapping system, it is not necessary to perform the outlier detection for these labs by IUPAC method. The results of outlier detection are listed in Table 5. Under ISO 3308 smoking regime, only one or two labs were excluded for each sample, while under ISO 20778 smoking regime, the excluded labs for each sample ranged between 1-4.

Table 5. The results of outlier detection

Sample	Method	Lab code			
		Overall		Pad+Pad	
		ISO 3308	ISO 20778	ISO 3308	ISO 20778
CM 9	Cochran	3	3, 12	8b	8a
	Grubbs				
KR 1R6F	Cochran	3, 8b	3	8b	8a
	Grubbs				
KR 2R5F	Cochran	12	12, 8a	8b	8a
	Grubbs		8b, 15		
Sample 1	Cochran	1	12, 8a	1	8a
	Grubbs				
Sample 2	Cochran	2, 12	8a	2	8a
	Grubbs				
Sample 3	Cochran	12, 8b	12, 7	8b	7
	Grubbs				
Sample 4	Cochran	8b	9, 8a	8b	9
	Grubbs	15	8b, 15		

^[1] Pure & Appl. Chem., Vol. 67, No. 2, pp. 331-343, 1995. Protocol for the design, conduct and interpretation of method-performance studies.

^[2] CORESTA Routine Analytical Chemistry Sub-Group Technical Report, 2013 Collaborative Study of CORESTA Monitors #7 (CM7) for the Determination of Test Piece Weight, TPM, Water, Nicotine, NFDPM, Carbon Monoxide and Puff Count Obtained Under Mainstream ISO and Intense Smoking Regimes.

5.2 Repeatability and Reproducibility Estimation

Following the ISO 5725-2^[1], the repeatability (r) and reproducibility (R) were respectively calculated from the data sets from the “Overall”, “Pad+Pad” and “Pad+Imp” trapping systems after the removal of outliers. As shown in Table 6, under ISO 3308 smoking regime, the maximum r(%) of the “Overall”, “Pad+Pad” and “Pad+Imp” trapping systems is 19,98 %, 19,67 % and 24,44 %, respectively. The maximum R(%) of the “Overall”, “Pad+Pad” and “Pad+Imp” trapping systems is 32,30 %, 30,64 % and 68,40 %, respectively. As shown in Table 7, under ISO 20778 smoking regime, the maximum r(%) of “Overall”, “Pad+Pad” and “Pad+Imp” trapping systems is 11,27 %, 10,80 % and 22,41 %, respectively. The maximum R(%) of “Overall”, “Pad+Pad” and “Pad+Imp” trapping systems is 25,62 %, 26,66 % and 37,79 %, respectively.

Under the ISO 3308 smoking regime, all the r and R values from the “Pad+Pad” trapping system were smaller than those from the “Pad+Imp” trapping system. Under ISO 20778 smoking regime, except for the r value of samples 2 and 4, the r and R values from the “Pad+Pad” trapping system were also smaller than those from the “Pad+Imp” trapping system.

Table 6. Repeatability and Reproducibility for HCN (µg/cig) under ISO 3308 smoking regime

Sample	Method	N of data	Mean	r	r (%)	R	R (%)
CM 9	Overall	21	139,34	12,33	8,85	26,69	19,15
	P+P	16	140,74	11,18	7,94	25,01	17,77
	P+I	5	134,84	18,04	13,38	30,24	22,42
KR 1R6F	Overall	19	95,67	11,47	11,99	16,92	17,69
	P+P	15	96,41	9,31	9,65	15,90	16,50
	P+I	5	93,97	22,97	24,44	23,74	25,27
KR 2R5F	Overall	19	12,82	2,56	19,98	4,14	32,30
	P+P	15	12,95	2,55	19,67	3,97	30,64
	P+I	4	13,81	3,26	23,60	9,45	68,40
Sample 1	Overall	20	26,96	4,29	15,93	7,99	29,63
	P+P	16	26,41	4,04	15,28	7,00	26,49
	P+I	4	29,11	5,17	17,77	9,45	32,45
Sample 2	Overall	19	53,54	7,46	13,94	11,54	21,56
	P+P	16	52,98	7,95	15,00	11,52	21,74
	P+I	4	59,82	7,21	12,06	20,95	35,02
Sample 3	Overall	19	83,50	8,77	10,50	19,86	23,79
	P+P	16	84,09	9,20	10,94	20,13	23,94
	P+I	4	81,83	18,45	22,55	23,62	28,86
Sample 4	Overall	19	103,54	11,01	10,63	17,18	16,59
	P+P	16	103,95	11,40	10,96	18,17	17,47
	P+I	4	95,63	13,30	13,91	34,79	36,38

Where $r(\%) = r/\text{Mean} \times 100\%$, $R(\%) = R/\text{Mean} \times 100\%$, P+P is Pad+Pad and P+I is Pad+Imp

^[1] ISO 5725-2: 1994: Accuracy (trueness and precision) of measurement methods and results – Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method.

Table 7. Repeatability and Reproducibility for HCN (µg/cig) under ISO 20778 smoking regime

Sample	Method	N of data	Mean	r	r (%)	R	R (%)
CM 9	Overall	20	302,70	27,53	9,09	51,53	17,02
	P+P	16	305,63	26,26	8,59	47,30	15,48
	P+I	5	319,12	71,50	22,41	120,59	37,79
KR 1R6F	Overall	20	394,90	44,49	11,27	101,16	25,62
	P+P	15	399,01	37,42	9,38	90,60	22,71
	P+I	5	402,66	66,89	16,61	105,06	26,09
KR 2R5F	Overall	16	377,04	27,66	7,34	55,69	14,77
	P+P	15	371,43	31,25	8,41	78,60	21,16
	P+I	4	362,74	78,49	21,64	135,60	37,38
Sample 1	Overall	19	324,66	28,10	8,66	81,54	25,11
	P+P	16	327,29	27,71	8,47	76,94	23,51
	P+I	4	316,93	59,27	18,70	108,17	34,13
Sample 2	Overall	20	337,91	35,90	10,63	85,39	25,27
	P+P	16	338,69	36,18	10,68	90,30	26,66
	P+I	4	337,93	61,11	18,08	77,58	22,96
Sample 3	Overall	19	265,71	23,68	8,91	65,00	24,46
	P+P	16	269,24	23,88	8,87	62,12	23,07
	P+I	4	259,32	51,43	19,83	96,00	37,02
Sample 4	Overall	17	248,68	21,97	8,84	33,71	13,56
	P+P	16	245,89	26,55	10,80	46,26	18,81
	P+I	4	233,99	17,52	7,49	74,31	31,76

Where $r(\%) = r/\text{Mean} \times 100 \%$, $R(\%) = R/\text{Mean} \times 100 \%$, P+P is Pad+Pad and P+I is Pad+Imp

5.3 The Number of Smoked Cigarettes Influencing Repeatability and Reproducibility

Under ISO 3308 regime, 20 cigarettes are required to be smoked per replicate and under ISO 20778 regime, the number of required smoked cigarettes is 10. We re-estimated the repeatability and reproducibility after removal of the data sets that did not meet the number of smoked cigarettes. The “Overall” repeatability and reproducibility were the only results shown in Table 8. Compared with those in Table 6 and Table 7, the r and R values in Table 8 decreased slightly when the data sets that did not meet the required number of smoked cigarettes were excluded.

Table 8. Repeatability and Reproducibility for HCN ($\mu\text{g}/\text{cig}$) from data sets meeting the requirements of the number of smoked cigarettes

Sample	smoking regime	N Labs	Mean	r	r(%)	R	R(%)
CM 9	ISO 3308	16	140,86	11,43	8,11	25,36	18,00
	ISO 20778	15	306,70	25,21	8,22	43,59	14,21
KR 1R6F	ISO 3308	14	96,17	9,41	9,78	17,14	17,82
	ISO 20778	14	406,56	38,40	9,44	73,33	18,04
KR 2R5F	ISO 3308	15	12,93	2,49	19,28	4,07	31,45
	ISO 20778	14	378,14	28,84	7,63	58,77	15,54
Sample 1	ISO 3308	15	26,50	3,60	13,60	7,21	27,22
	ISO 20778	15	332,00	28,04	8,45	70,11	21,12
Sample 2	ISO 3308	16	53,71	7,63	14,21	11,74	21,86
	ISO 20778	15	345,24	35,51	10,29	80,12	23,21
Sample 3	ISO 3308	15	85,12	8,48	9,97	19,12	22,46
	ISO 20778	14	272,61	22,87	8,39	56,66	20,78
Sample 4	ISO 3308	15	104,78	11,27	10,76	16,40	15,65
	ISO 20778	14	249,46	22,44	9,00	35,13	14,08

5.4 Z-scores

Based on ISO 13528, the Z-scores for each lab were calculated from the “Overall” data sets and are shown in Figure 3. The Z-score is intended to indicate whether the laboratory results are within the normal range of other laboratories. It is expected that most of the Z-scores should fall within the range of ± 2 . Values such as $2 \leq |z| < 3$ should be interpreted as a warning signal, and data sets having values with $3 \leq |z|$ should be treated as an “action signal” to investigate laboratory performance. Z-score values of the data sets of each lab under ISO 3308 and ISO 20778 smoking regimes can be found in Table 9 and Table 10, respectively. Under ISO 3308 smoking regime, Z-scores of Sample 2 at Lab 12 and Sample 4 at Lab 15 are 3,27 and -3,02, respectively. Under ISO 20778 smoking regimen, Z-scores do not exceed the threshold value of “action signal”. It can be found in Appendix **Table E1** that the two outlier data sets are all from the “Pad+Imp” trapping system.

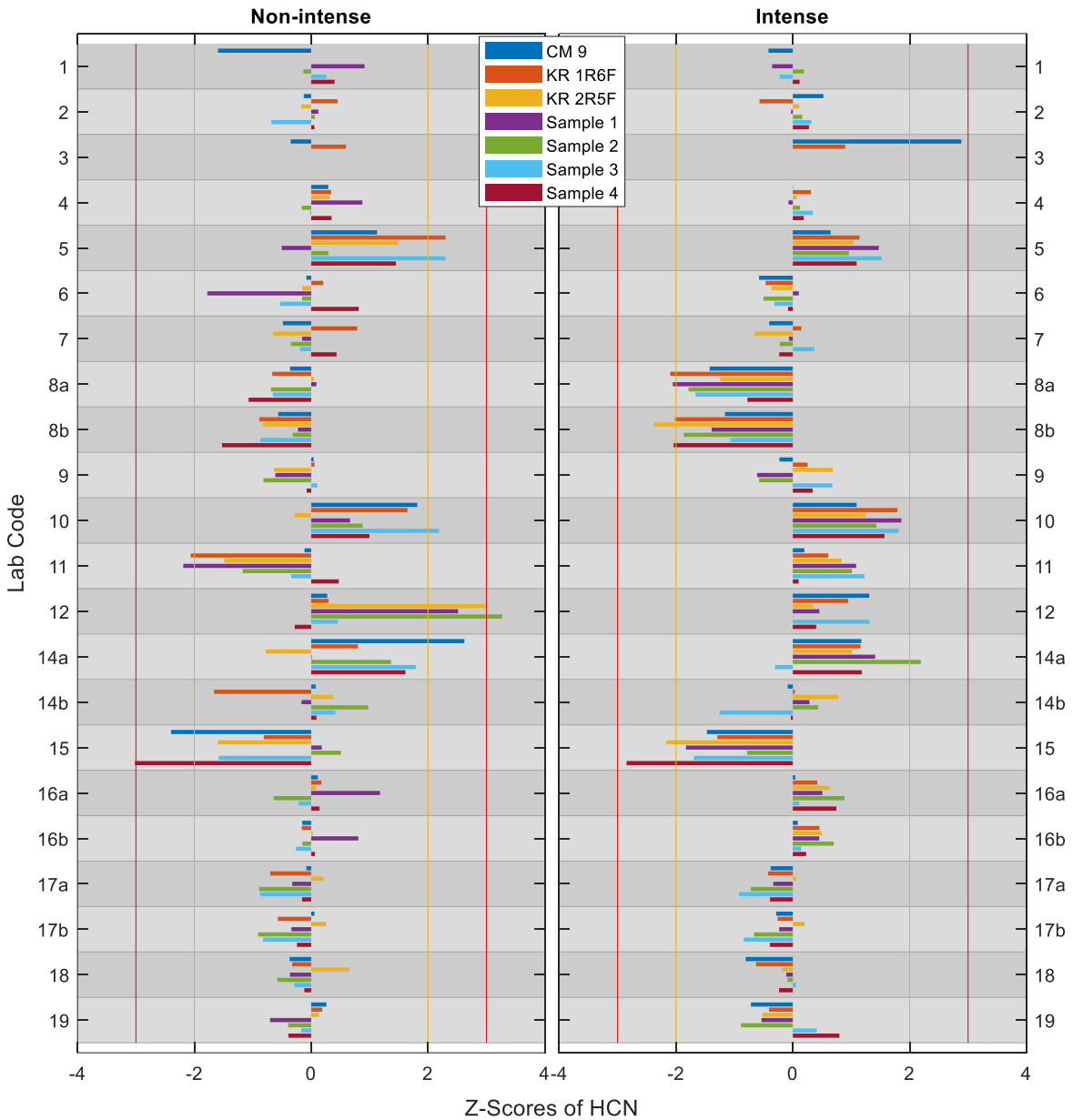


Figure 3. Z-scores for each lab under ISO 3308 and ISO 20778 smoking regimes

Table 9. Z-scores for each lab under ISO 3308 smoking regime

Lab Code	CM 9	KR 1R6F	KR 2R5F	Sample 1	Sample 2	Sample 3	Sample 4
1	-1,60	NA	NA	0,91	-0,11	0,26	0,40
2	-0,13	0,45	-0,17	0,12	0,08	-0,68	0,05
3	-0,35	0,59	NA	NA	NA	NA	NA
4	0,29	0,34	0,32	0,88	-0,14	-0,02	0,35
5	1,13	2,30	1,49	-0,50	0,31	2,30	1,45
6	-0,08	0,20	-0,16	-1,78	-0,13	-0,53	0,81
7	-0,48	0,79	-0,66	-0,15	-0,32	-0,19	0,43

Lab Code	CM 9	KR 1R6F	KR 2R5F	Sample 1	Sample 2	Sample 3	Sample 4
8a	-0,36	-0,67	0,05	0,09	-0,66	-0,66	-1,07
8b	-0,57	-0,89	-0,83	-0,23	-0,69	-0,87	-1,53
9	0,04	0,06	-0,64	-0,61	-0,79	0,10	-0,08
10	1,82	1,65	-0,29	0,67	0,89	2,19	1,00
11	-0,11	-2,06	-1,49	-2,19	-1,14	-0,34	0,47
12	0,28	0,30	2,99	2,51	3,26	0,45	-0,28
14a	2,62	0,80	-0,78	0,01	1,37	1,79	1,61
14b	0,08	-1,66	0,38	-0,17	0,98	0,42	0,09
15	-2,40	-0,81	-1,60	0,18	0,52	-1,58	-3,02
16a	0,11	0,17	0,09	1,18	-0,62	-0,21	0,14
16b	-0,15	-0,16	0,03	0,81	-0,13	-0,26	0,06
17a	-0,08	-0,70	0,21	-0,32	-0,86	-0,87	-0,16
17b	0,06	-0,57	0,26	-0,34	-0,88	-0,82	-0,24
18	-0,37	-0,33	0,65	-0,36	-0,55	-0,29	-0,12
19	0,26	0,19	0,13	-0,70	-0,37	-0,17	-0,39

Where the values $2 \leq |z| < 3$ are marked in yellow font, the values $3 \leq |z|$ are marked in red font.

Table 10. Z-scores for each lab under ISO 20778 smoking regime

Lab Code	CM 9	KR 1R6F	KR 2R5F	Sample 1	Sample 2	Sample 3	Sample 4
1	-0,42	NA	NA	-0,35	0,20	-0,23	0,10
2	0,52	-0,57	0,11	-0,03	0,17	0,32	0,27
3	2,89	0,90	NA	NA	NA	NA	NA
4	0,00	0,31	0,07	-0,07	0,14	0,34	0,40
5	0,65	1,14	1,04	1,47	0,97	1,52	1,08
6	-0,58	-0,46	-0,36	0,10	-0,49	-0,32	-0,09
7	-0,40	0,15	-0,65	-0,07	-0,21	0,37	-0,24
8a	-1,42	-2,10	-1,24	-2,05	-1,78	-1,66	-0,79
8b	-1,16	-2,02	-2,37	-1,39	-1,86	-1,07	-2,05
9	-0,23	0,25	0,69	-0,61	-0,57	0,68	0,33
10	1,09	1,79	1,25	1,86	1,44	1,81	1,55
11	0,20	0,61	0,84	1,08	1,03	1,23	0,09
12	1,31	0,95	0,35	0,45	-0,52	1,31	0,39
14a	1,17	1,16	1,02	1,41	2,21	-0,31	1,17
14b	-0,09	0,03	0,78	0,28	0,45	-1,25	-0,04
15	-1,47	-1,29	-2,17	-1,83	-0,47	-1,69	-2,85

Lab Code	CM 9	KR 1R6F	KR 2R5F	Sample 1	Sample 2	Sample 3	Sample 4
16a	0,04	0,42	0,63	0,51	0,90	0,10	0,73
16b	0,08	0,45	0,47	0,45	0,71	0,14	0,22
17a	-0,38	-0,42	0,06	-0,33	-0,71	-0,92	-0,40
17b	-0,28	-0,26	0,21	-0,23	-0,65	-0,84	-0,40
18	-0,81	-0,63	-0,19	-0,11	-0,08	0,05	-0,25
19	-0,72	-0,41	-0,52	-0,54	-0,88	0,41	0,78

Where the values $2 \leq |z| < 3$ are marked in yellow font.

6. Discussion

In the 2022 collaborative study for HCN in mainstream cigarette smoke, 5 sets of test data were submitted with the “Pad+Imp” trapping system and 17 sets of test data were submitted with the “Pad+Pad” trapping system. The RSD (%) values from the “Pad+Pad” trapping system are smaller than those from the “Pad+Imp” system under both smoking regimes, except for the sample 2 under ISO 20778 smoking regime.

The paired *t*-test was carried out to compare mean smoke yields of HCN achieved by the two trapping systems. No statistically significant differences were observed between the data from the “Pad+Pad” and “Pad+Imp” trapping systems. In most cases, results from the two trapping systems are consistent with each other, which suggests that either the “Pad+Pad” or the “Pad+Imp” method sub-type can be adopted in the trapping of HCN in mainstream cigarette smoke.

The outliers are detected by IPUAC method. The data sets removed are mostly due to the Cochran Test in the procedure of IUPAC. While using Z-scores to assess laboratory performance, only two data sets were found as outliers which came from the “Pad+Imp” trapping system.

After removal of the outliers from the “Overall” data sets, the maximum values of *r*(%) and *R*(%) were 19,98 % and 32,30 %, respectively, under ISO 3308 regime; under ISO 20778 regime, the maximum values were 11,27 % and 25,62 %, respectively. After exclusion of the data sets that did not meet the required number of smoked cigarettes, the calculated *r* and *R* values were slightly smaller. The fewer data sets with “Pad+Imp” might be one of the reasons for the greater values of *r* and *R* than those from the “Pad+Pad” trapping system. Also, the experimental step of using the impinger might be the cause of the greater *r* and *R* values since the HCN level will decrease in the impinger alkaline solution^[1].

7. Conclusions

No statistically significant differences were observed between the measured results with the “Pad+Pad” and “Pad+Imp” trapping systems under both ISO 3308 and ISO 20778 regimes.

Though the labs were not all running the same method sub-type, the repeatability and reproducibility suggested that the test results were within the range that would be deemed acceptable.

^[1] Xingyu Liu, Li Ma, Jun Zhou, Yanjun Ma, Ruoshi Bai, Lihong Yan. The influence of nitrogen dioxide on the determination of hydrogen cyanide in mainstream and sidestream cigarette smoke and the improvement of the determination method by continuous flow analyzer. *Analytical Methods*, 2014, 6: 9841-9849.

Appendix A - Study Protocol



CORESTA Smoke Analysis Sub-Group

Project Title:	Project 296-HCN Study 2 - r&R Collaborative Study
Type of Document:	Protocol
Date:	July 8, 2022
Written by:	Jun Zhou, Rana Tayyarah

1. Objective

The main objective of this study is to develop a CRM for the determination of hydrogen cyanide (HCN) in mainstream cigarette smoke by collection of smoke under both non-intense (ISO 3308) and intense (ISO 20778) smoking regimes.

2. Time Schedule

Date	Activity
July 2022-Aug 20, 2022	Study Coordinator to distribute protocol, drafted CRM and template. Call for participants
Aug 20-Oct 31, 2022	Test sample distribution. Commercial cigarette samples will be shipped by BCF CNTC. KRF Cigarettes and CM Cigarettes shall be obtained by labs themselves.
Nov 1-Dec 15, 2022	Sample testing and test data submission
Dec 15, 2022-Jan 31, 2023	Data analysis and accuracy review
Feb 1-March 31, 2023	Technical report draft.
April 1-April 30, 2023	Workstream review and next steps decisions
May 1-Aug 20, 2023	Technical report and CRM revision. Final report submitted to Scientific Commission

3. Methods

3.1 Test Products

Sample	Description	ISO 3308 'tar' level	Number of Cigarettes to procure
KR 2R5F	American Blend	1	200 pieces
Sample 1	American blend – charcoal filter	3	200 pieces
Sample 2	American blend – charcoal filter	5	200 pieces
KR 3R4F	American Blend	8	200 pieces
Sample 3	Virginia Blend	8	200 pieces
Sample 4	Virginia Blend	11	200 pieces
CM9	Virginia Blend	16	200 pieces

The participating labs shall contact Dr. Xingyu Liu of BCF CNTC at [REDACTED] for the shipment of the commercial cigarette samples 1- 4. Be sure to provide shipping instructions.

3.2 Study Control

The method for the determination of hydrogen cyanide is based on continuous flow analysis. Laboratories are asked to apply the method according to the submitted drafted Method and use the number of cigarettes smoked per smoke run as recommended for the individual smoking regimes.

Furthermore, laboratories are asked to record confirmation of the number of cigarettes per smoke run as well as record puff count data in the templates distributed with the study protocol.

Additionally, two different trapping systems will be investigated consisting of either

- a combination of two Cambridge Filter Pads (CFP) of which one is impregnated with a sodium hydroxide solution as described in the drafted Method or
- a combination of a CFP with a liquid trap as described in the drafted Method.

In order to avoid a loss of HCN it is strongly recommended to analyze samples on the same day when smoking is performed especially for a liquid trap.

Laboratories are requested to follow the procedures described in the drafted Method except for the extraction and continuous flow analysis.

3.3 Sampling

A composite of the cigarette samples should be prepared for conditioning according to ISO 8243:2006. If a substantial period of time is expected to occur between the times when the test pieces are smoked with the different smoking regimes, then two separate composite samples should be prepared, one for each smoking regime.

3.4 Testing Atmosphere

Samples shall be tested after completion of equilibrium testing according to internal laboratory practices. The composite samples should be conditioned in accordance with standard procedures and recorded for every smoking run.

3.5 Sample Handling

All samples shall be stored under the laboratory conditions that will be used for testing and remain in their original packaging prior to testing. Or, if coming from a laboratory's own supplies, they should be stored according to internal practices if it is compliant with the vendor specifications.

Blank Glass fiber filter pads to be used for smoke collection shall be stored under conditions equivalent to the testing atmosphere for a minimum of 12 hours before use. If treated pads are used, laboratories should follow method specifications and provide information in the method details section of the data reporting template.

3.6 Filter Ventilation Zone Blocking (ISO 20778 Smoking)

The blocking of the filter ventilation zone will be achieved by means consistent with the ISO requirement.

3.7 Replicates and Run Order

Five replicates for each sample cigarette and reference cigarette were requested. The experiments should be generated by applying ISO 3308 and ISO 20778 regimes according to the randomized experimental plan.

Randomized Design for 5 Replicates of 7 Test Samples

Run Number	Mainstream Experiment Number				
	1	2	3	4	5
1	Sample 4	KR 2R5F	CM 9	KR 1R6F	Sample 2
2	KR 1R6F	Sample1	Sample 2	CM 9	Sample 3
3	KR 2R5F	KR 1R6F	Sample 3	Sample 1	Sample 4
4	Sample 2	CM 9	Sample 4	KR 2R5F	Sample 1
5	Sample 3	Sample 4	Sample 1	Sample 2	KR 2R5F
6	CM 9	Sample 2	KR 2R5F	Sample 3	KR 1R6F
7	Sample 1	Sample 3	KR 1R6F	Sample 4	CM 9

There are no timing requirements for spacing of smoking runs. Run # and collection and testing dates shall be reported in the data template.

3.8 Smoking Parameters

Smoking Regime	Reference	Description
1	ISO 3308	Non-Intense
2	ISO 20778	Intense

3.9 Analytes and Measures

Report results for puff count (/cig), Total particulate matter (TPM) (mg/cig), and the analytes listed below using the data template provided.

Analyte	Reporting units
HCN (total)	µg/cig
HCN (pad, optional)	µg/cig
HCN (impinger, optional)	µg/cig

4. Data Submission

The attached template shall be used for data submission. Please supply data in the requested format without creating new cells or rows in the spreadsheet.

Results shall be reported back to [REDACTED] on or before Dec. 15, 2022.

5. Data Analysis

The data will be analysed statistically in accordance with appropriate ISO guidelines by the study statistical coordinator.

6. Reference Documents

Data reporting Template	Excel spreadsheet provided (file attached to protocol)
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Appendix B - Analytical Method

DRAFT CORESTA RECOMMENDED METHOD N°106

See final version on the CORESTA website www.coresta.org

DETERMINATION OF HYDROGEN CYANIDE IN MAINSTREAM CIGARETTE SMOKE BY CONTINUOUS FLOW ANALYZER

(July 2022)

0. INTRODUCTION

At the outset of this work, discussions in the CORESTA Smoke Analysis Sub-Group determined that most laboratories used a method involving Continuous Flow Analyzer for the determination of hydrogen cyanide (HCN) in mainstream cigarette smoke because they considered it most suitable and so this was chosen as the basis of the Recommended Method. The method involved smoke collection using a combination of glass fibre filter pad followed by impinger trap containing dilute sodium hydroxide solution or using two fibre filter pads (one pad treated with ethanol/ water solution of sodium hydroxide plus one blank pad). HCN was determined using a Continuous Flow Analyzer based on the detection of the coloring system formed by the reaction of cyanides with some chromogenic reagents, such as isonicotinic acid/1, 3-dimethyl barbituric acid and pyridine/pyrazolone.

Initial joint experiments and on-going discussions addressed some methodological aspects that needed to be considered before moving to a Recommended Method. The Recommended Method was produced through a final collaborative experiment involving xx laboratories from xx countries using the ISO 3308 and ISO 20778 smoking regime. Measurement data using both the ISO 3308 and ISO 20778 smoking regime from a 2022 collaborative study comprising xx laboratories are also provided. This method includes notes to inform other laboratories that might wish to adopt it about some of the main features that need to be well controlled to provide data as robust and consistent as the repeatability and reproducibility data provided. Statistical evaluations were made according to ISO recommendations and are included.

1. FIELD OF APPLICATION

This Recommended Method is applicable to the determination of hydrogen cyanide in mainstream cigarette smoke, using a Continuous Flow Analyzer.

2. REFERENCES

ISO 3308, *Routine analytical cigarette-smoking machine – Definitions and standard conditions*

ISO 20778, *Cigarettes — Routine analytical cigarette smoking machine — Definitions and standard conditions with an intense smoking regime*

ISO 3402, *Tobacco and tobacco products – Atmosphere for conditioning and testing*

ISO 4387, *Cigarettes – Determination of Total and Nicotine-free Dry Particulate Matter Using a Routine Analytical Smoking Machine*

ISO 8243, *Cigarettes – Sampling*

3. TERMS AND DEFINITIONS

No specific terms and definitions are listed in this document.

4. PRINCIPLE

Cigarettes are smoked on a standard smoking machine that has been fitted with a glass fibre filter (Cambridge Filter Pad, CFP) followed by an impinger (trapping system 1) or by a combination of CFP treated by ethanol – water sodium of hydroxide solution and a blank glass fibre filter (trapping system 2). HCN collected on pads is then extracted with sodium hydroxide solution. HCN in the CFP extract and impinger are determined using a Continuous Flow Analyzer based on the detection of the coloring system formed by the reaction of cyanides with chromogenic reagents, such as isonicotinic acid/1,3-dimethyl barbituric acid and pyridine/pyrazolone. The absorbance is detected at 600 nm.

5. APPARATUS AND EQUIPMENT

5.1 Normal laboratory apparatus and equipment is needed, in particular, the following items

- Equipment needed to perform conditioning of tobacco products
- Equipment needed to perform marking for butt length
- Equipment needed to perform smoking of tobacco products complying with ISO 3308 and ISO 20778
- Tubing (e.g. Nalgene) 1/4" ID X 3/8" OD
- Soap bubble manometer to measure puff volume
- Leak tester to ensure no air leaking of smoking machine

5.2 The necessary general laboratory equipment for the preparation of samples, standards, and reagents

- Analytical balance, capable of measuring to four decimal places
- Dispenser capable of delivering volume of 50 mL
- Triangular flask (e.g., 150 mL, 500 mL)
- Impinger for trapping mainstream smoke (e.g., 70 mL, 250 nominal volume)
- Volumetric flask with ground glass joint (e.g., 50 mL, 100 mL)
- Transfer pipettes (100 µL, 1000 µL, 5 mL, 10 mL)
- Magnetic Stirrer and stir bars
- Sample cups for autoanalyzer
- Wrist-action shaker
- 5 cc Disposable Syringe
- Syringe Filter (0.45 µm, PES or equivalent)
- Glass fibre filter pad

5.3 Computer-controlled Continuous Flow Analyzer (or equivalent) consisting of

- Technicon I Autosampler.
- Technicon II Peristaltic Pump.
- Technicon III Chemistry Manifold.
- Technicon IV Colorimeter (with 600 nm filter) .

6. REAGENTS AND SUPPLIES

All reagents shall be, at the least, recognized as analytical reagent grade. Specific reagents may vary based on Continuous Flow Analyzer equipment used.

- 6.1 Chloramine T (CAS 127-65-1) \geq 98.0 % purity
- 6.2 Potassium biphthalate (CAS 127-65-1) \geq 99.5 % purity
- 6.3 1,3-Dimethylbarbituric acid (CAS 769-42-6) \geq 98.0 % purity
- 6.4 Isonicotinic acid (CAS 55-22-1) \geq 99.0 % purity
- 6.5 Polyoxyethylene lauryl ether (Brij-35) (CAS 9002-92-0) \geq 90.0 % purity
- 6.6 Anhydrous ethanol (CAS) \geq 99.0 % purity
- 6.7 Sodium hydroxide (CAS 1310-73-2) \geq 95 % purity
- 6.8 Certified stock sodium cyanide (e.g., 50.0 mg/L)

NOTE: The use of this method can involve hazardous materials, operations and equipment. This method does not purport to address all the safety problems associated with its use. It is the responsibility of the user of this method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

7. PREPARATION OF SOLUTIONS (Recommended)

7.1 Brij 35 solution (25 %)

Add 1 L deionized water to 250 g Brij 35, warm and stir until dissolved.

7.2 Chloramine-T solution

Dissolve 2.0 g chloramine-T, weighed to 0.01 g, in 500 mL of deionized water. Mix well. This solution shall be stored at 4 °C and prepared monthly.

7.3 Buffer solution

Dissolve 2.3 g sodium hydroxide and 20.5 g potassium biphthalate, weighed to 0.01 g, in 1 L of deionized water. Add 0.5 mL of Brij-35 solution and mix well. This solution shall be stored at 4 °C and prepared monthly.

7.4 Chromogenic reagent solution

Dissolve 7.0 g sodium hydroxide, 16.8 g 1,3-dimethylbarbituric acid and 13.6 g isonicotinic acid, weighed to 0.01 g, in 1 L of deionized water and then diluted to 1 L. Add 0.5 mL of Brij-35 solution and mix well. This solution shall be stored at 4 °C and prepared monthly.

NOTE: The pH of buffer solution and chromogenic reagent solution should be adjusted to 5.3 by sodium hydroxide and hydrochloric acid solution.

7.5 Ethanol - water solution of sodium hydroxide (1 M)

Dissolve 4.0 g sodium hydroxide pellets in 50 mL of deionized water and then add the same volume of ethanol (50 mL) into the water solution. Mix well. Store at room temperature and prepared monthly.

7.6 Sodium hydroxide solution (0.1 M)

Dissolve 8 g sodium hydroxide pellets in 2 L of deionized water. Stir until completely dissolved. Store at room temperature.

8. PREPARATION OF STANDARDS

8.1 Primary (1°) stock standard

Certified stock sodium cyanide was commercially obtained to be the primary (1°) stock standard. The concentration was confirmed by the supplier.

8.2 Working standards

Take appropriate volumes (0.10 mL to 6.0 mL, for example) of the 1° stock standard and dilute to the prescribed volumes with 0.1 M sodium hydroxide solution to prepare at least five working standards. For example, 0.100, 0.500, 1.000, 3.000, 4.000, 6.000 mg/L of working standards were prepared by diluting 0.1, 0.5, 1.0, 3.0, 4.0, 6.0 mL aliquots of 1° stock standard (50 mg/L). Store at 4 °C and prepare weekly.

NOTE: The calibration should cover the concentration range of interest.

9. SAMPLING

As applicable, sampling is performed in accordance with ISO 8243.

10. TOBACCO PRODUCT PREPARATION

Conditioning of the cigarettes is done in accordance with ISO 3402.

11. SAMPLE GENERATION

11.1 Smoking Machine Setup

The smoking parameters for which the method has been studied are set out in ISO 3308 and in ISO 20778 as shown in Table 1.

Table 1 - Cigarette Smoking Parameters Employed

Smoking regime	Puff volume (mL)	Puff frequency (seconds)	Puff duration (seconds)	Ventilation Blocking (%)
ISO 3308	35	60	2	0
ISO 20778	55	30	2	100

11.2 Trapping Systems

Two different trapping systems can be either used. Trapping system 1 consists of a CFP combined with an impinger. Trapping system 2 consists of a treated and a blank CFP.

11.2.1 Trapping System 1 – CFP and Impinger

Assemble the HCN mainstream apparatus on the smoking machine by connecting cigarette holder with one CFP and a 70 mL fritted stem impinger containing 30 mL 0.1 M sodium hydroxide solution for ISO Non-Intense regime and a 250 mL fritted stem impinger containing 90 mL 0.1 M sodium hydroxide solution for ISO Intense regime (Figure 1).

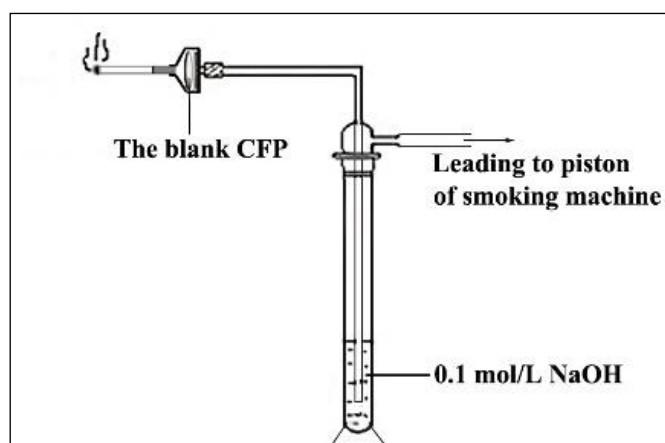


Figure 1 - Example of a suitable Trapping System 1

NOTE: It is recommended that the trapping efficiency be checked when validating this method under both the ISO 3308 and ISO 20778 smoking regimes. To check the trapping efficiency of the method, add an additional impinger and follow the method accordingly. Analyze each impinger individually for the compounds of interest. If no compounds are detected in the additional impinger then only the prescribed number of impinger is required to trap the vapour phase HCN effectively, otherwise an additional impinger is required.

11.2.2 Trapping System 2 – Treated CFP and blank CFP

Impregnate a CFP with 1.0 M ethanol-water solution of sodium hydroxide and place together with a blank CFP in a filter holder connected to the smoking machine. The steps to prepare CFP impregnation and assembly of trapping system are described below:

11.2.2.1 Pre-treatment of CFP

- Linear smoking machine: place a 44 mm conditioned CFP into a culture disk (diameter: 60 mm) or a beaker containing 2.0 mL ethanol - water solution of sodium hydroxid. After being fully soaked, it is put into a fume hood for about ten minutes to evaporate ethanol and then transferred into the laboratory conditioner and conditioned for 1~3 h at $22\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ and $60\% \pm 2\%$ of relative humidity.
- Rotary smoking machine: place a 92 mm conditioned CFP into a culture disk (diameter: 100 mm) or a beaker containing 8.0 mL ethanol - water solution of sodium hydroxide. After being fully soaked, it is put into a fume hood for about ten minutes to evaporate ethanol and then transferred into the laboratory conditioner and conditioned for 1~3 h at $22\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ and $60\% \pm 2\%$ of relative humidity.

11.2.2.2 Assembly of Trapping System 2

- Place the treated CFP and a blank CFP into the cigarette holder.
- The treated CFP should be in the front facing the incoming smoke and the blank CFP on the back.
- All the rough sides of both CFPs should face the incoming smoke.
- Assemble the cigarette holder in the smoking machine and connect the rear section of cigarette holder to the tubing leading to piston of smoking machine.
- Examine the system with a leak tester to ensure no air leaking is present.

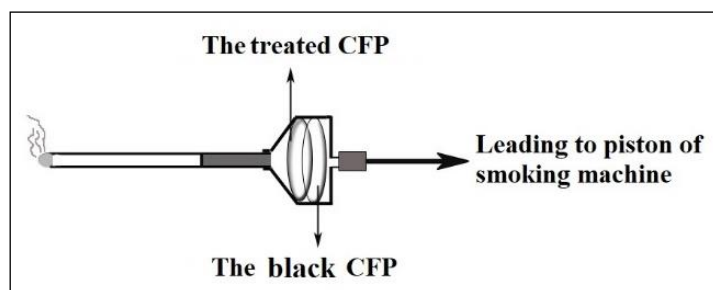


Figure 2 - Example of Trapping System 2

11.3 Cigarette smoking

The cigarettes are smoked according to ISO 4387 with the following modifications:

- Check the puff volume of each port and adjust accordingly.
- Typically 4 cigarettes are smoked per replicate for ISO 3308 and 2 cigarettes per replicate for ISO 20778 smoking regime using a linear smoking machine. If using a rotary smoking machine, the cigarette smoked per replicate should be increased.

12. SAMPLE ANALYSIS

12.1 Extraction from Trapping System 1

- After smoking, remove the pad, fold into quarters (with the condensate inside) and wipe the inside of the holder with the pad.
- For 44 mm CFP, place the pad into a 100 mL triangular flask containing 50 mL of 0.1M sodium hydroxide solution. For 92 mm CFP, place the pads into a 500 mL triangular flask containing 100 mL of 0.1M sodium hydroxide solution.
- Shake the triangular flasks at 200 rpm for 30 min on the wrist action shaker. The extract was filtered into sample cup by 0.45 µm membrane filter.
- Transfer the impinger solution into a volumetric flask (e.g. 100 mL, 200mL). Rinse the impinger with 0.1 M sodium hydroxide solution with appropriate volumes (for example: 10 mL for 70 mL impinger, 30 mL for 250 mL impinger) three times and add to the volumetric flask to the nominal volume. Transfer the solution to sample cup.

12.2 Extraction from Trapping System 2

- After smoking, remove the two pads together from its holder, fold into quarters (with the condensate inside) and wipe the inside of the holder with the pad.
- Place the pads into a 150 mL triangular flask containing 100 mL 0.1 M sodium hydroxide solution. For 92 mm CFP, place the pads into a 500 mL triangular flask containing 250 mL 0.1 M sodium hydroxide solution.
- Shake the triangular flasks at 200 rpm for 30 min on the wrist action shaker. The extract was filtered into sample cup by 0.45 µm membrane filter.

12.3 Continuous flow analysis (Example)

Examples of detection conditions for analysis of samples obtained from both trapping systems are shown in the paragraphs below. The examples shown are applicable for “Seal AA3” equipment^[5].

12.3.1 Conditions for Continuous flow analysis (Example)

- Sample time: 60 seconds.
- Wash time: 60 seconds.
- Aspirate the system with deionized water (with 1 mL of Brij 35 added into 1 L deionised water) for approximately 30 minutes.
- Transfer the reagent pickup tubes to their appropriate reagents (APPENDIX A) and aspirate until a steady baseline and uniform bubble patterns are observed.
- The bubbles should flow smoothly through the Continuous Flow Analyzer and be uniform in shape and spacing with rounded ends.
- The Auto-sampler is operated at a sampling rate of 30 per hour with a 1:1 sample to wash ratio. Sufficient time should be required for the system to become stable with the reagents being pumped.

^[5] This example is given for the convenience of the users of this Recommended Method and does not constitute endorsement of this instrument.

12.3.2 Calibrations

- This calculation is performed automatically by the analytical instrument. Plot a graph of corrected absorbance units for each standard against HCN content (APPENDIX B). The calibration graph should have an R^2 value of >0.999 . The response obtained for test samples should fall in the range of calibration curve.

12.3.3 Determination of Response Factor

- A calibration curve for HCN is prepared by plotting the concentration of the standards versus the peak height to determine appropriate response factors.
- The concentration of HCN in mainstream smoke is quantified by the external standard method.

12.3.4 Sample Quantification

- The amount of HCN in mainstream smoke per cigarette trapped by CFP is calculated as follows:

$$M_{CFP} = \frac{1,038 \times C \times V}{N}$$

Where

M_{CFP} is the amount of HCN in mainstream smoke trapped by CFP per cigarette, expressed in $\mu\text{g}/\text{cigarette}$;

1.038 is the conversion coefficient of cyanide ion to hydrogen cyanide;

C is the response factor of HCN in CFP derived from the calibration curve, expressed in $\mu\text{g}/\text{mL}$;

V is the volume of CFP extract, expressed in mL;

N is the number of cigarettes smoked per CFP.

- The amount of HCN in mainstream smoke trapped by impinger is calculated as follows.

$$M_{impinger} = \frac{1,038 \times C \times V}{N}$$

Where

$M_{impinger}$ is the amount of HCN in mainstream smoke per cigarette trapped by impinger, expressed in $\mu\text{g}/\text{cigarette}$;

1.038 is the conversion coefficient of cyanide ion to hydrogen cyanide;

C is the response factor of cyanide ion in impinger derived from the calibration, expressed in $\mu\text{g}/\text{mL}$;

V is the final volume of impinger solution, expressed in mL;

N is the number of cigarettes smoked per impinger.

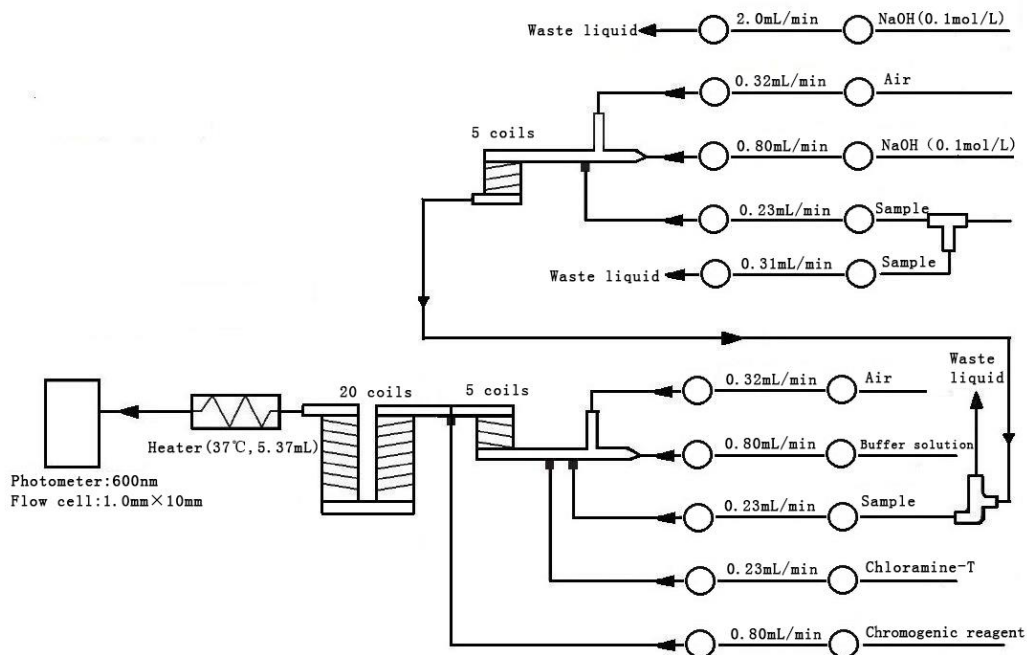
NOTE: For trapping system 1, the total HCN in mainstream smoke per cigarette shall be the combination of HCN trapped by CFP and impinger. For trapping system 2, the total HCN in mainstream smoke per cigarette shall be the HCN trapped by CFPs.

13. REPEATABILITY AND REPRODUCIBILITY

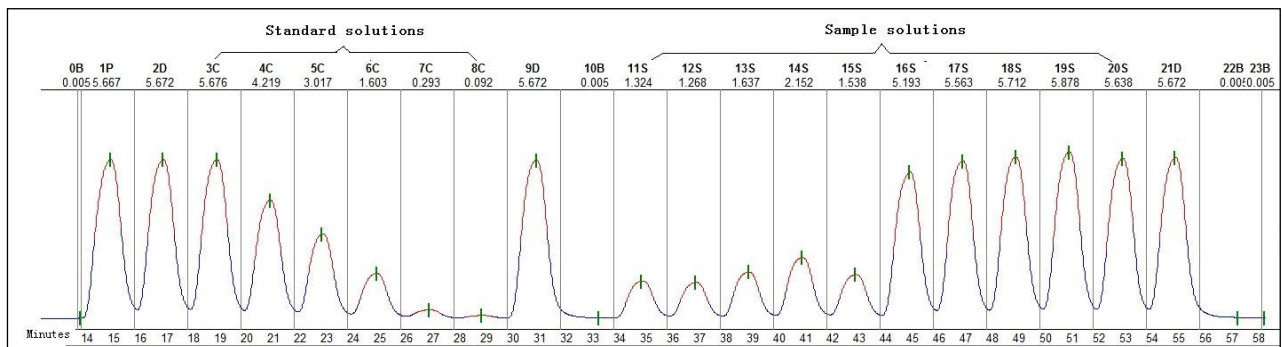
14. REPORT

The report shall state the amount of HCN in micrograms per cigarette. HCN yields in the mainstream smoke of cigarette in $\mu\text{g}/\text{cigarette}$ were rounded to the nearest 0.01 μg . The report shall include all conditions not specified in this Analytical Method or regarded as optional that may have influenced the results. The report shall also give all details necessary for the identification of each sample.

DRAFT CRM APPENDIX A - The manifold of Continuous Flow Analyzer for hydrogen cyanide detection



DRAFT CRM APPENDIX B - Typical graph of hydrogen cyanide determination by Continuous Flow Analyzer



Appendix C - Summarized Data

Table C1. Statistical results of CM9 and KR 1R6F treated by Pad+Pad

Lab code		CM 9				KR 1R6F			
		ISO 3308		ISO 20778		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct(/cig)	HCN (µg/cig)	Puff Ct (/cig)
1	Avg	125,77	7,96	297,93	10,3	NA	NA	NA	NA
	Stdev	2,56	0,44	15,95	0,4	NA	NA	NA	NA
	%RSD	2,03	5,52	5,35	3,6	NA	NA	NA	NA
2	Avg	138,05	7,97	318,67	10,2	97,70	8,0	376,77	8,3
	Stdev	3,98	0,12	6,77	0,1	1,72	0,2	6,98	0,1
	%RSD	2,88	1,49	2,12	1,3	1,76	2,3	1,85	0,6
4	Avg	141,55	7,62	307,21	10,3	97,18	7,4	406,01	8,3
	Stdev	3,88	0,04	6,90	0,4	2,24	0,1	10,46	0,2
	%RSD	2,74	0,59	2,25	3,8	2,30	2,0	2,58	2,1
5	Avg	148,53	7,72	321,35	10,6	106,29	7,5	433,70	8,1
	Stdev	2,05	0,04	10,24	0,2	4,10	0,1	15,91	0,2
	%RSD	1,38	0,58	3,19	2,0	3,86	1,0	3,67	2,4
6	Avg	138,43	7,98	294,37	10,1	96,55	7,1	380,25	7,5
	Stdev	4,18	0,31	11,86	0,4	4,17	0,2	13,88	0,2
	%RSD	3,02	3,90	4,03	4,0	4,32	2,6	3,65	2,1
7	Avg	135,07	7,64	298,20	10,6	99,26	7,5	400,58	8,3
	Stdev	7,02	0,32	11,93	0,6	2,48	0,2	16,96	0,3
	%RSD	5,20	4,20	4,00	5,6	2,50	2,2	4,23	3,2
8a	Avg	136,09	7,98	275,71	10,8	92,49	7,8	325,88	9,2

Lab code		CM 9				KR 1R6F			
		ISO 3308		ISO 20778		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct(/cig)	HCN (µg/cig)	Puff Ct (/cig)
	Stdev	5,34	0,04	16,10	0,1	3,73	0,2	25,21	0,3
	%RSD	3,93	0,56	5,84	1,2	4,03	2,1	7,74	3,1
8b	Avg	134,38	7,17	281,47	10,4	91,47	7,2	328,53	8,5
	Stdev	8,78	0,06	12,95	0,4	9,77	0,02	4,73	0,04
	%RSD	6,53	0,85	4,60	3,4	10,69	0,3	1,44	0,5
9	Avg	139,46	7,66	302,06	9,8	95,85	7,0	404,20	8,0
	Stdev	2,76	0,15	6,43	0,4	1,56	0,1	14,50	0,2
	%RSD	1,98	2,02	2,13	4,3	1,63	1,5	3,59	2,9
10	Avg	154,30	7,80	331,20	10,8	103,25	7,2	455,40	8,2
	Stdev	0,29	0,07	7,53	0,1	3,99	0,1	9,20	0,2
	%RSD	0,19	0,91	2,27	1,0	3,86	2,1	2,02	2,5
11	Avg	138,15	8,46	311,50	12,2	86,00	7,9	416,01	9,0
	Stdev	5,14	0,27	13,49	0,4	3,74	0,1	20,15	0,2
	%RSD	3,72	3,19	4,33	3,6	4,35	0,9	4,84	1,9
14a	Avg	161,03	7,58	332,98	10,8	99,32	7,4	434,30	8,5
	Stdev	2,34	0,08	5,27	0,4	2,41	0,2	3,53	0,3
	%RSD	1,45	1,10	1,58	3,2	2,42	2,6	0,81	3,8
16a	Avg	140,06	7,64	308,06	10,7	96,41	7,4	409,62	8,3
	Stdev	2,57	0,28	5,13	0,1	3,02	0,1	8,82	0,1
	%RSD	1,84	3,62	1,66	1,0	3,13	1,0	2,15	1,3
17a	Avg	138,41	7,74	298,74	9,9	92,33	7,3	381,70	8,1
	Stdev	3,09	0,09	5,25	1,0	0,36	0,1	3,89	0,1

Lab code		CM 9				KR 1R6F			
		ISO 3308		ISO 20778		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct(/cig)	HCN (µg/cig)	Puff Ct (/cig)
	%RSD	2,23	1,16	1,76	9,8	0,39	2,0	1,02	0,8
17b	Avg	139,57	7,66	300,83	9,9	92,94	7,3	387,07	8,2
	Stdev	4,11	0,11	5,43	0,9	0,39	0,1	8,94	0,1
	%RSD	2,95	1,49	1,80	9,1	0,42	1,8	2,31	1,1
18	Avg	136,02	8,18	289,32	10,4	94,08	7,5	374,79	8,4
	Stdev	5,65	0,16	9,12	0,3	3,82	0,1	10,80	0,2
	%RSD	4,15	2,01	3,15	2,4	4,06	1,0	2,88	2,3
19	Avg	141,27	7,85	291,29	10,1	96,49	6,9	382,14	8,1
	Stdev	2,88	0,25	4,61	0,2	2,36	0,2	12,39	0,2
	%RSD	2,04	3,22	1,58	2,4	2,45	2,4	3,24	3,0

Where NA = not applicable

Table C2. Statistical results of KR 2R5F and Sample 1 treated by Pad+Pad

Lab code		KR 2R5F				Sample 1			
		ISO 3308		ISO 20778		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct(/cig)	HCN (µg/cig)	Puff Ct (/cig)
1	Avg	NA	NA	NA	NA	29,31	6,20	311,09	7,3
	Stdev	NA	NA	NA	NA	3,31	0,25	6,83	0,4
	%RSD	NA	NA	NA	NA	11,28	4,11	2,20	4,9
2	Avg	12,77	8,15	370,13	7,1	27,37	6,98	320,80	7,1
	Stdev	1,18	0,15	7,24	0,1	1,70	0,08	6,16	0,1
	%RSD	9,25	1,84	1,96	1,7	6,21	1,21	1,92	1,7
4	Avg	13,59	7,84	368,89	7,4	29,21	6,32	319,46	7,3
	Stdev	1,98	0,15	5,26	0,3	1,92	0,22	6,66	0,2
	%RSD	0,15	0,02	0,01	0,0	6,58	3,43	2,08	2,9
5	Avg	15,55	7,48	398,14	7,4	25,84	6,32	365,62	7,2
	Stdev	0,21	0,11	12,30	0,1	1,45	0,13	9,87	0,1
	%RSD	0,01	0,01	0,03	0,0	5,60	2,06	2,70	1,7
6	Avg	12,80	7,64	355,87	6,9	22,72	6,22	324,76	7,2
	Stdev	0,72	0,21	12,59	0,1	1,73	0,19	10,80	0,2
	%RSD	0,06	0,03	0,04	0,0	7,61	3,09	3,32	2,9
7	Avg	11,96	7,68	347,14	7,4	26,69	6,34	319,70	7,2
	Stdev	0,86	0,19	11,67	0,2	1,40	0,25	7,51	0,2
	%RSD	0,07	0,03	0,03	0,0	5,23	3,96	2,35	2,5
8a	Avg	13,14	8,42	329,48	7,9	27,29	6,56	260,31	7,4
	Stdev	1,43	0,41	27,79	0,3	2,51	0,35	29,32	0,5
	%RSD	0,11	0,05	0,08	0,0	9,19	5,35	11,26	6,3

Lab code		KR 2R5F				Sample 1			
		ISO 3308		ISO 20778		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct(/cig)	HCN (µg/cig)	Puff Ct (/cig)
8b	Avg	11,68	7,46	295,51	7,3	26,51	6,06	280,17	7,4
	Stdev	2,14	0,09	19,34	0,2	1,81	0,05	9,32	0,1
	%RSD	0,18	0,01	0,07	0,0	6,82	0,74	3,33	1,8
9	Avg	11,99	7,82	387,38	7,1	25,57	5,92	303,41	7,0
	Stdev	0,63	0,16	9,96	0,2	0,96	0,16	12,00	0,2
	%RSD	0,05	0,02	0,03	0,0	3,77	2,78	3,95	3,2
10	Avg	12,58	7,86	404,33	7,7	28,70	6,16	377,18	7,4
	Stdev	0,37	0,13	18,71	0,1	1,75	0,09	4,29	0,1
	%RSD	0,03	0,02	0,05	0,0	6,10	1,45	1,14	1,2
11	Avg	10,58	8,72	391,94	8,3	21,71	7,12	354,06	8,7
	Stdev	1,02	0,18	9,50	0,2	0,74	0,11	16,45	0,5
	%RSD	0,10	0,02	0,02	0,0	3,43	1,54	4,65	6,0
14a	Avg	11,76	7,74	397,38	7,5	27,09	6,32	363,82	7,5
	Stdev	0,62	0,21	4,83	0,1	0,35	0,20	19,21	0,2
	%RSD	0,05	0,03	0,01	0,0	1,30	3,24	5,28	2,9
16a	Avg	13,20	7,57	385,60	7,6	29,95	6,09	336,80	7,3
	Stdev	0,46	0,29	9,92	0,2	1,25	0,20	6,86	0,3
	%RSD	0,03	0,04	0,03	0,0	4,17	3,23	2,04	4,2
17a	Avg	13,41	7,58	368,58	7,3	26,28	6,20	311,68	7,2
	Stdev	0,14	0,23	4,69	0,1	0,44	0,10	5,72	0,1
	%RSD	0,01	0,03	0,01	0,0	1,68	1,61	1,84	1,0
	Avg	13,49	7,48	372,96	7,3	26,24	6,20	314,70	7,2

Lab code		KR 2R5F				Sample 1			
		ISO 3308		ISO 20778		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct(/cig)	HCN (µg/cig)	Puff Ct (/cig)
17b	Stdev	0,50	0,23	3,73	0,1	0,49	0,12	4,38	0,1
	%RSD	0,04	0,03	0,01	0,0	1,87	1,98	1,39	1,2
18	Avg	14,15	7,64	361,17	7,3	26,18	6,24	318,33	7,7
	Stdev	0,80	0,23	16,74	0,3	1,18	0,26	10,05	0,2
	%RSD	0,06	0,03	0,05	0,0	4,49	4,18	3,16	2,4
19	Avg	13,28	7,61	351,21	7,0	25,34	6,10	305,69	7,5
	Stdev	0,67	0,14	4,04	0,2	1,41	0,10	6,75	0,3
	%RSD	0,05	0,02	0,01	0,0	5,55	1,66	2,21	4,6

Where NA = not applicable

Table C3. Statistical results of Sample 2 and Sample 3 treated by Pad+Pad

Lab code		Sample 2				Sample 3			
		ISO 3308		ISO 20778		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct(/cig)	HCN (µg/cig)	Puff Ct (/cig)
1	Avg	53,72	6,00	341,06	7,5	84,99	6,16	262,47	8,2
	Stdev	1,62	0,12	9,50	0,2	4,57	0,21	4,12	0,1
	%RSD	3,01	2,04	2,79	3,1	5,37	3,37	1,57	1,6
2	Avg	54,66	6,46	340,11	7,1	79,06	6,38	274,30	7,8
	Stdev	9,11	0,26	8,52	0,2	4,54	0,16	10,45	0,1
	%RSD	16,66	4,06	2,50	2,4	5,74	2,58	3,81	1,2
4	Avg	53,59	5,98	338,99	7,3	83,25	6,22	274,87	8,1
	Stdev	3,64	0,13	4,58	0,2	3,27	0,16	2,50	0,1
	%RSD	6,79	2,18	1,35	2,5	3,93	2,64	0,91	1,2
5	Avg	55,76	6,06	364,05	7,2	97,77	6,20	300,45	7,7
	Stdev	4,24	0,13	22,35	0,2	3,98	0,07	8,27	0,3
	%RSD	7,60	2,21	6,14	2,1	4,07	1,14	2,75	4,4
6	Avg	53,63	6,08	320,17	7,1	80,02	6,12	260,52	8,1
	Stdev	2,45	0,15	11,36	0,1	3,77	0,13	6,36	0,3
	%RSD	4,57	2,44	3,55	1,6	4,71	2,13	2,44	3,4
7	Avg	52,73	5,96	328,56	7,4	82,16	6,14	275,42	8,3
	Stdev	1,49	0,05	12,55	0,1	3,31	0,21	17,02	0,4
	%RSD	2,83	0,92	3,82	2,0	4,03	3,38	6,18	4,2
8a	Avg	51,10	6,22	281,70	7,5	79,25	6,46	231,24	8,6
	Stdev	3,50	0,25	42,23	0,3	3,93	0,23	8,02	0,4

Lab code		Sample 2				Sample 3			
		ISO 3308		ISO 20778		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct(/cig)	HCN (µg/cig)	Puff Ct (/cig)
	%RSD	6,85	4,00	14,99	4,3	4,96	3,56	3,47	5,1
8b	Avg	52,86	5,79	279,26	7,3	77,92	5,90	244,16	7,7
	Stdev	3,28	0,09	17,90	0,3	7,63	0,08	11,14	0,3
	%RSD	6,20	1,47	6,41	3,8	9,80	1,42	4,56	3,9
9	Avg	50,48	5,86	317,94	6,9	84,01	5,90	282,13	7,4
	Stdev	3,61	0,18	6,52	0,2	2,84	0,09	12,16	0,2
	%RSD	7,15	3,10	2,05	2,6	3,39	1,46	4,31	3,1
10	Avg	58,53	6,10	378,17	7,4	97,11	6,06	306,85	7,9
	Stdev	2,77	0,07	6,07	0,2	2,04	0,11	13,70	0,3
	%RSD	4,73	1,16	1,61	2,5	2,10	1,88	4,47	3,4
11	Avg	48,80	7,00	365,65	9,1	81,22	6,86	294,05	9,3
	Stdev	2,90	0,00	17,92	0,5	2,84	0,09	8,60	0,2
	%RSD	5,94	0,00	4,90	5,1	3,50	1,30	2,92	2,3
14a	Avg	60,84	6,02	401,03	7,5	94,60	6,20	260,74	8,7
	Stdev	1,07	0,11	2,79	0,4	0,87	0,25	5,24	0,4
	%RSD	1,76	1,82	0,70	4,8	0,92	4,11	2,01	4,3
16a	Avg	51,31	5,97	361,78	7,3	82,02	6,04	269,66	8,3
	Stdev	3,41	0,08	11,46	0,2	2,71	0,16	11,75	0,1
	%RSD	6,64	1,33	3,17	2,6	3,31	2,71	4,36	1,3
17a	Avg	50,14	5,94	313,73	7,2	77,88	6,10	247,38	8,0
	Stdev	0,96	0,05	2,13	0,1	1,42	0,10	0,43	0,1

Lab code		Sample 2				Sample 3			
		ISO 3308		ISO 20778		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct(/cig)	HCN (µg/cig)	Puff Ct (/cig)
	%RSD	1,91	0,92	0,68	1,2	1,82	1,64	0,17	1,1
17b	Avg	50,05	5,88	315,41	7,2	78,19	6,24	249,15	8,1
	Stdev	0,62	0,16	4,78	0,1	1,87	0,09	5,69	0,2
	%RSD	1,24	2,79	1,51	1,6	2,39	1,43	2,28	2,4
18	Avg	51,61	6,62	332,54	7,5	81,55	6,32	268,58	8,5
	Stdev	2,16	0,25	19,09	0,3	4,32	0,22	9,44	0,2
	%RSD	4,18	3,76	5,74	4,1	5,30	3,43	3,52	2,4
19	Avg	52,49	5,99	308,67	7,4	82,29	5,91	276,30	8,3
	Stdev	3,87	0,09	20,86	0,3	2,83	0,16	5,26	0,2
	%RSD	7,37	1,54	6,76	3,4	3,44	2,75	1,90	2,9

Table C4. Statistical results of Sample 4 treated by Pad+Pad

Lab code		Sample 4			
		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)
1	Avg	104,79	6,22	245,36	8,7
	Stdev	1,70	0,15	2,97	0,1
	%RSD	1,62	2,38	1,21	1,0
2	Avg	102,11	6,55	248,06	8,7
	Stdev	4,19	0,15	9,04	0,1
	%RSD	4,10	2,34	3,64	1,4
4	Avg	104,39	6,24	246,55	8,8
	Stdev	1,28	0,15	8,52	0,2
	%RSD	1,23	2,43	3,46	1,7
5	Avg	112,88	6,34	261,73	8,5
	Stdev	6,17	0,09	9,91	0,1
	%RSD	5,47	1,41	3,79	1,5
6	Avg	107,98	6,38	242,08	8,8
	Stdev	3,21	0,26	7,82	0,2
	%RSD	2,98	4,06	3,23	1,8
7	Avg	105,05	6,36	239,53	8,7
	Stdev	2,50	0,15	4,50	0,2
	%RSD	2,38	2,38	1,88	2,7
8a	Avg	93,43	6,50	230,39	9,2
	Stdev	2,74	0,12	20,33	0,6

Lab code		Sample 4			
		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)
	%RSD	2,93	1,88	8,82	6,9
8b	Avg	89,92	5,90	209,19	8,7
	Stdev	8,31	0,06	3,92	0,1
	%RSD	9,24	0,93	1,88	0,7
9	Avg	101,10	5,93	249,12	8,4
	Stdev	2,86	0,11	21,68	0,3
	%RSD	2,83	1,82	8,70	3,2
10	Avg	109,39	6,16	269,73	8,8
	Stdev	6,11	0,05	11,95	0,1
	%RSD	5,59	0,89	4,43	1,0
11	Avg	105,35	7,02	245,10	10,2
	Stdev	6,56	0,15	12,73	0,4
	%RSD	6,23	2,11	5,19	3,7
14a	Avg	114,15	6,26	263,21	8,9
	Stdev	6,99	0,17	5,96	0,2
	%RSD	6,12	2,67	2,27	2,2
16a	Avg	102,79	6,06	255,93	8,8
	Stdev	4,71	0,07	8,02	0,1
	%RSD	4,58	1,19	3,13	0,9
17a	Avg	100,50	6,16	236,89	8,5
	Stdev	1,21	0,05	3,54	0,1

Lab code		Sample 4			
		ISO 3308		ISO 20778	
		HCN (µg/cig)	Puff Ct (/cig)	HCN (µg/cig)	Puff Ct (/cig)
	%RSD	1,21	0,89	1,50	1,5
17b	Avg	99,82	6,26	236,84	8,4
	Stdev	1,24	0,05	4,09	0,1
	%RSD	1,25	0,87	1,73	1,3
18	Avg	100,80	6,64	239,47	8,8
	Stdev	3,12	0,09	7,87	0,2
	%RSD	3,09	1,35	3,28	2,1
19	Avg	98,68	6,12	256,78	8,7
	Stdev	1,77	0,07	11,14	0,3
	%RSD	1,79	1,09	4,34	3,2

Table C5. Statistical results of CM 9 by Pad+Imp

Lab code		ISO 3308					ISO 20778				
		Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)
3	Avg	136,17	57,62	78,55	7,8	17,52	370,78	86,31	284,47	10,6	48,74
	Stdev	10,10	9,25	14,46	0,2	0,64	49,96	18,03	40,66	0,3	3,23
	%RSD	7,42	16,06	18,40	2,5	3,66	13,48	20,89	14,29	3,0	6,63
12	Avg	141,41	62,26	79,14	7,6	16,34	335,98	97,40	238,58	10,4	45,08
	Stdev	6,43	2,89	3,59	0,3	0,41	21,07	5,60	16,17	0,4	3,76
	%RSD	4,55	4,64	4,54	3,5	2,51	6,27	5,75	6,78	4,0	8,35
14b	Avg	139,75	76,13	63,62	7,6	16,75	305,20	105,78	199,42	10,7	45,38
	Stdev	3,07	0,63	2,47	0,3	0,39	3,02	1,42	3,49	0,4	1,17
	%RSD	2,20	0,83	3,88	4,2	2,32	0,99	1,34	1,75	3,9	2,59
15	Avg	119,06	60,84	58,22	7,8	16,97	274,66	86,44	188,23	10,5	45,76
	Stdev	6,44	2,56	4,80	0,3	0,93	14,86	3,93	12,24	0,1	1,78
	%RSD	5,41	4,21	8,24	4,3	5,50	5,41	4,55	6,50	1,3	3,89
16	Avg	137,83	73,28	64,55	7,9	16,74	308,98	101,54	207,44	10,7	46,88
	Stdev	3,04	4,72	4,40	0,2	0,39	4,98	2,28	7,15	0,4	1,65
	%RSD	2,20	6,43	6,82	2,6	2,32	1,61	2,24	3,45	3,5	3,53

Table C6. Statistical results of KR 1R6F by Pad+Imp

Lab code		ISO 3308					ISO 20778				
		Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)
3	Avg	98,36	37,60	60,76	7,7	10,24	425,55	91,72	333,83	8,4	43,77
	Stdev	13,41	6,10	10,21	0,2	0,46	35,87	11,92	45,73	0,4	2,57
	%RSD	13,63	16,22	16,80	2,2	4,45	8,43	13,00	13,70	4,4	5,87
12	Avg	96,97	38,57	58,40	7,1	9,04	427,30	119,58	307,72	8,7	46,50
	Stdev	7,99	4,02	4,32	0,2	0,36	16,57	4,58	13,60	0,4	4,27
	%RSD	8,24	10,42	7,39	2,7	3,94	3,88	3,83	4,42	4,1	9,19
14b	Avg	87,87	39,82	48,04	7,4	9,34	396,87	139,25	257,62	8,8	48,45
	Stdev	1,22	0,60	1,01	0,3	0,50	9,02	2,93	6,54	0,6	2,75
	%RSD	1,39	1,52	2,09	3,9	5,31	2,27	2,10	2,54	6,6	5,67
15	Avg	91,82	41,23	50,59	7,7	10,28	352,69	109,34	243,35	8,6	47,28
	Stdev	8,51	3,06	6,52	0,2	0,59	33,69	5,95	28,59	0,4	3,56
	%RSD	9,27	7,43	12,89	2,5	5,76	9,55	5,44	11,75	4,2	7,53
16	Avg	94,85	42,65	52,19	7,4	9,89	410,86	136,98	273,89	8,3	45,77
	Stdev	3,50	2,62	2,49	0,1	0,11	4,36	4,17	5,36	0,1	1,70
	%RSD	3,69	6,13	4,77	1,0	1,09	1,06	3,05	1,96	1,6	3,71

Table C7. Statistical results of KR 2R5F by Pad+Imp

Lab code		ISO 3308					ISO 20778				
		Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN	Puff Ct (/cig)	TPM (mg/cig)
12	Avg	18,07	5,44	12,62	7,7	2,43	377,21	102,51	274,70	7,2	28,94
	Stdev	2,15	0,69	1,55	0,2	0,14	50,66	14,64	39,56	0,5	6,08
	%RSD	11,90	12,67	12,31	2,4	5,90	13,43	14,28	14,40	6,3	21,00
14b	Avg	13,69	3,89	9,81	7,6	2,32	390,30	135,46	254,84	7,4	33,18
	Stdev	0,35	0,13	0,32	0,4	0,18	2,77	2,03	2,78	0,3	1,39
	%RSD	2,56	3,44	3,25	4,8	7,88	0,71	1,50	1,09	4,6	4,17
15	Avg	10,39	1,52	8,88	8,0	2,01	301,76	79,78	221,98	7,1	30,01
	Stdev	0,67	0,26	0,46	0,3	0,15	22,44	6,65	19,43	0,2	3,79
	%RSD	6,46	17,24	5,13	3,8	7,55	7,44	8,33	8,75	2,2	12,64
16	Avg	13,11	3,46	9,65	7,7	2,26	381,70	123,48	258,22	7,6	29,25
	Stdev	0,35	0,61	0,44	0,1	0,11	1,68	6,01	4,36	0,2	1,79
	%RSD	2,63	17,65	4,51	1,9	4,71	0,44	4,87	1,69	2,4	6,13

Table C8. Statistical results of Sample 1 by Pad+Imp

Lab code		ISO 3308					ISO 20778				
		Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)
12	Avg	33,22	11,15	22,07	6,1	3,30	335,28	78,06	257,21	7,4	26,58
	Stdev	2,75	0,92	1,90	0,2	0,30	37,64	6,78	32,68	0,7	4,50
	%RSD	8,28	8,23	8,60	2,5	8,97	11,23	8,69	12,70	9,4	16,92
14b	Avg	26,66	8,41	18,25	6,3	3,27	330,18	98,15	232,03	7,2	34,64
	Stdev	0,24	0,29	0,12	0,1	0,10	7,97	2,89	6,18	0,2	0,30
	%RSD	0,88	3,44	0,65	1,9	3,15	2,41	2,94	2,66	3,0	0,85
15	Avg	27,51	7,60	19,91	6,5	3,33	267,05	69,62	197,43	7,1	29,10
	Stdev	2,12	0,66	1,61	0,3	0,10	15,53	4,85	10,76	0,3	0,62
	%RSD	7,70	8,63	8,10	5,2	2,93	5,82	6,96	5,45	3,6	2,14
16	Avg	29,04	10,08	18,96	6,1	3,19	335,20	94,90	240,31	7,2	27,73
	Stdev	1,13	0,63	1,18	0,1	0,10	5,88	6,28	9,16	0,2	1,60
	%RSD	3,89	6,26	6,20	1,4	3,08	1,76	6,62	3,81	2,2	5,78

Table C9. Statistical results of Sample 2 by Pad+Imp

Lab code		ISO 3308					ISO 20778				
		Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)
12	Avg	69,87	25,58	44,29	6,0	5,57	335,41	87,14	248,27	6,7	28,82
	Stdev	4,43	1,46	3,01	0,0	0,40	36,46	12,12	27,69	0,4	5,43
	%RSD	6,34	5,71	6,81	0,8	7,15	10,87	13,91	11,15	5,4	18,85
14b	Avg	58,99	22,33	36,66	5,9	5,38	348,29	101,12	247,16	7,6	37,52
	Stdev	1,15	0,41	0,82	0,1	0,35	4,71	1,69	3,83	0,4	1,32
	%RSD	1,94	1,86	2,23	0,9	6,57	1,35	1,67	1,55	4,9	3,52
15	Avg	56,78	18,74	38,04	6,2	5,08	311,74	77,80	233,94	7,4	32,21
	Stdev	1,66	0,88	1,12	0,1	0,25	20,83	4,08	17,10	0,4	2,51
	%RSD	2,92	4,68	2,94	1,9	4,94	6,68	5,25	7,31	5,2	7,81
16	Avg	53,65	20,38	33,27	6,0	5,46	356,30	97,99	258,30	7,2	31,44
	Stdev	1,53	1,85	0,90	0,1	0,18	9,08	1,58	9,87	0,2	1,63
	%RSD	2,84	9,08	2,72	1,4	3,23	2,55	1,62	3,82	2,9	5,20

Table C10. Statistical results of Sample 3 by Pad+Imp

Lab code		ISO 3308					ISO 20778				
		Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)
12	Avg	86,21	36,39	49,82	6,1	8,63	295,97	78,20	217,77	7,8	35,66
	Stdev	12,53	3,69	8,90	0,2	1,05	33,63	11,19	23,34	0,2	5,57
	%RSD	14,53	10,13	17,87	3,5	12,12	11,36	14,31	10,72	2,1	15,63
14b	Avg	85,98	38,72	47,26	6,0	8,98	240,19	70,02	170,17	8,4	30,01
	Stdev	0,92	0,82	0,80	0,1	0,16	6,42	0,84	5,66	0,6	0,80
	%RSD	1,07	2,12	1,70	2,0	1,82	2,67	1,20	3,33	7,6	2,67
15	Avg	73,42	32,07	41,36	6,0	8,49	230,57	63,61	166,96	7,9	33,27
	Stdev	3,09	1,51	2,59	0,2	0,61	11,51	2,23	9,78	0,4	1,67
	%RSD	4,21	4,71	6,25	3,5	7,21	4,99	3,51	5,86	4,5	5,03
16	Avg	81,72	34,98	46,74	6,0	8,50	270,55	80,73	189,83	8,3	34,60
	Stdev	1,70	1,75	1,26	0,1	0,32	4,20	4,27	5,73	0,2	1,59
	%RSD	2,08	5,00	2,71	1,7	3,80	1,55	5,28	3,02	2,5	4,58

Table C11. Statistical results of Sample 4 by Pad+Imp

Lab code		ISO 3308					ISO 20778				
		Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Puff Ct (/cig)	TPM (mg/cig)
12	Avg	99,52	43,18	56,35	6,1	12,08	250,12	70,36	179,75	8,7	36,98
	Stdev	4,79	1,27	4,50	0,2	0,77	7,09	4,28	6,37	0,4	2,45
	%RSD	4,82	2,94	7,99	2,8	6,36	2,84	6,08	3,54	4,7	6,63
14b	Avg	102,40	53,30	49,10	6,3	12,83	242,88	76,59	166,29	8,7	41,37
	Stdev	0,76	0,46	0,99	0,2	0,34	2,59	1,38	1,78	0,4	0,88
	%RSD	0,74	0,86	2,02	2,5	2,68	1,06	1,80	1,07	4,8	2,12
15	Avg	78,41	38,05	40,36	6,2	11,95	195,73	58,94	136,79	8,6	36,73
	Stdev	7,78	3,52	4,31	0,2	0,85	9,49	2,95	6,95	0,4	1,95
	%RSD	9,92	9,25	10,68	3,7	7,15	4,85	5,00	5,08	5,0	5,30
16	Avg	102,20	48,70	53,50	6,1	12,62	247,25	72,32	174,92	8,7	36,64
	Stdev	2,11	2,65	3,06	0,1	0,32	2,53	1,74	2,35	0,2	1,56
	%RSD	2,06	5,44	5,73	1,6	2,52	1,03	2,41	1,35	2,9	4,25

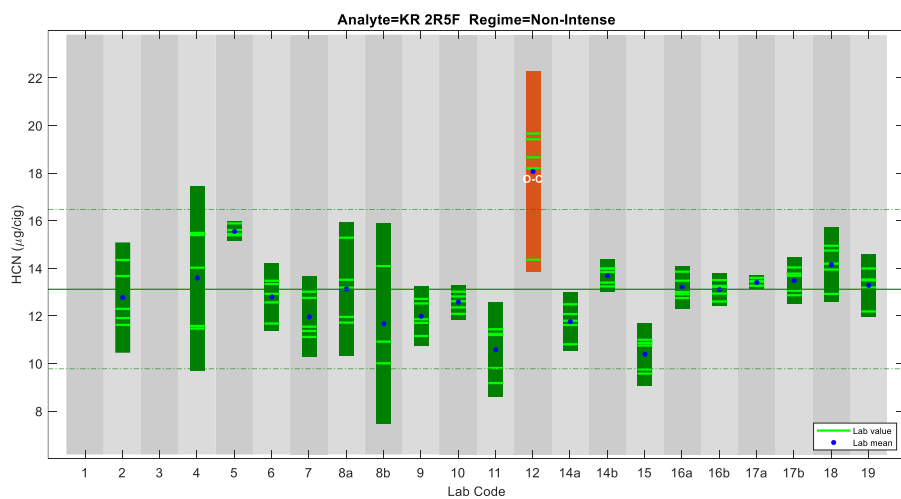
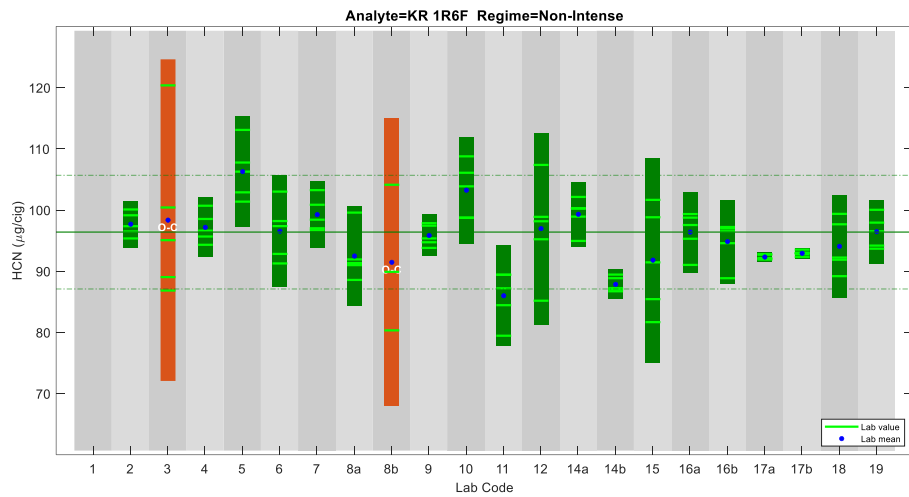
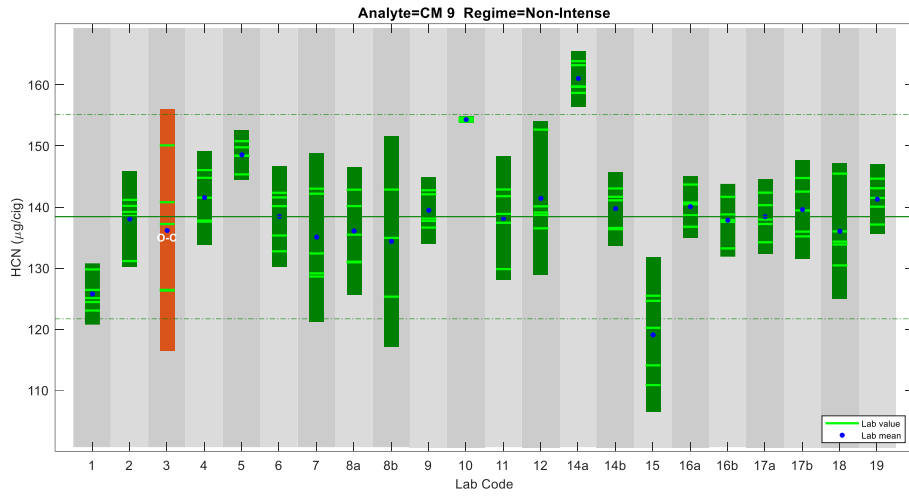
Table C12. Number of Cigarettes used

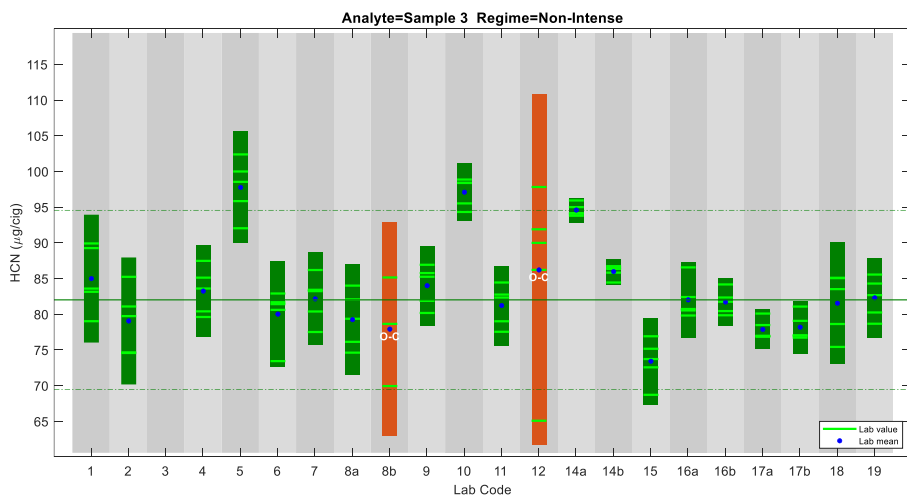
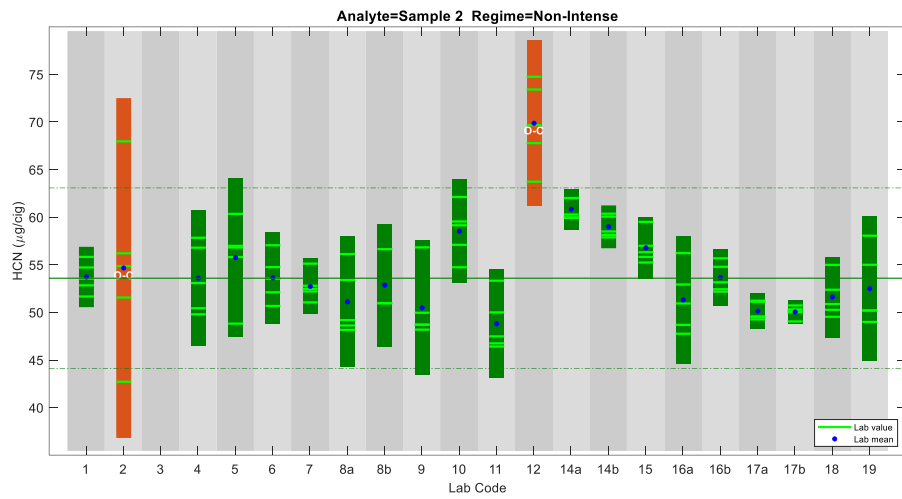
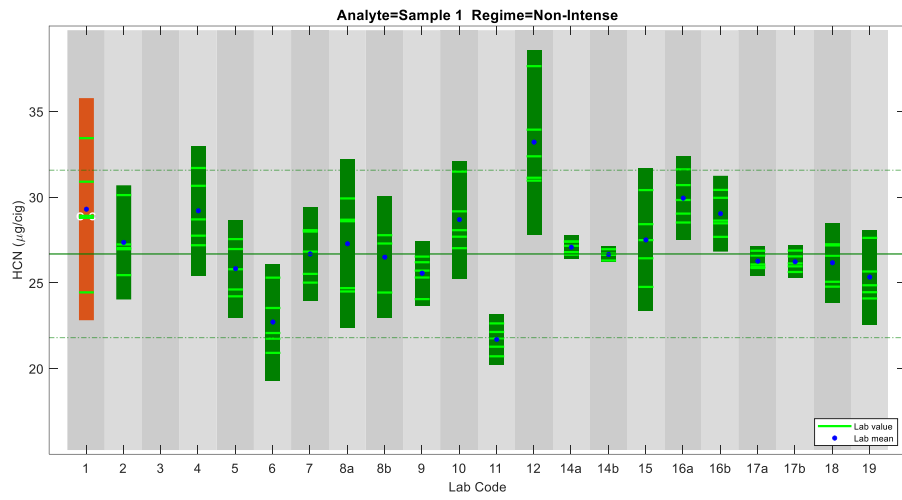
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	Sample 1	20	10		KR 1R6F	3	1
	Sample 2	20	10		KR 2R5F	3	1
	Sample 3	20	10		Sample 1	3	1
	Sample 4	20	10		Sample 2	3	1
2	CM 9	10	5	14a	Sample 3	3	1
	KR 1R6F	10	5		Sample 4	3	1
	KR 2R5F	10	5		CM 9	20	10
	Sample 1	10	5		KR 1R6F	20	10
	Sample 2	10	5		KR 2R5F	20	10
	Sample 3	10	5		Sample 1	20	10
3	Sample 4	10	5	Sample 2	20	10	
	CM 9	4	2	Sample 3	20	10	
3	KR 1R6F	4	2	Sample 4	20	10	
	4	CM 9	20	10	14b	CM 9	20
KR 1R6F		20	10	KR 1R6F		20	10
KR 2R5F		20	10	KR 2R5F		20	10
Sample 1		20	10	Sample 1		20	10
Sample 2		20	10	Sample 2		20	10
Sample 3		20	10	Sample 3		20	10
Sample 4		20	10	Sample 4		20	10
5	CM 9	20	10	15	CM 9	3	2
	KR 1R6F	20	10		KR 1R6F	3	2
	KR 2R5F	20	10		KR 2R5F	3	2
	Sample 1	20	10		Sample 1	3	2
	Sample 2	20	10		Sample 2	3	2
	Sample 3	20	10		Sample 3	3	2
	Sample 4	20	10		Sample 4	3	2
6	CM 9	20	10	16a	CM 9	20	10
	KR 1R6F	20	10		KR 1R6F	20	10
	KR 2R5F	20	10		KR 2R5F	20	10
	Sample 1	20	10		Sample 1	20	10
	Sample 2	20	10		Sample 2	20	10
	Sample 3	20	10		Sample 3	20	10
	Sample 4	20	10		Sample 4	20	10

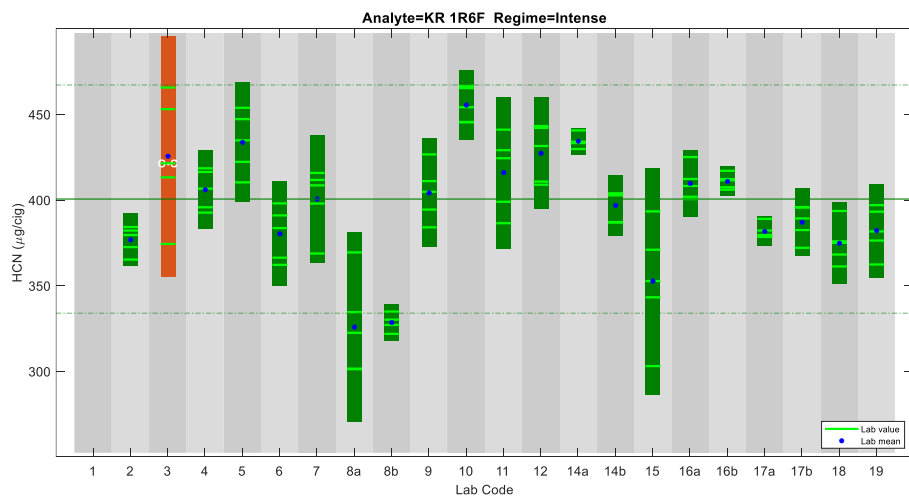
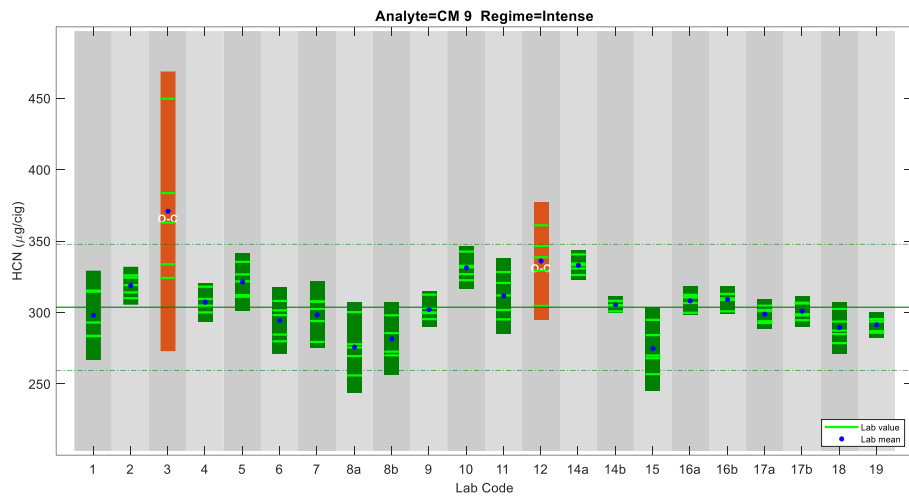
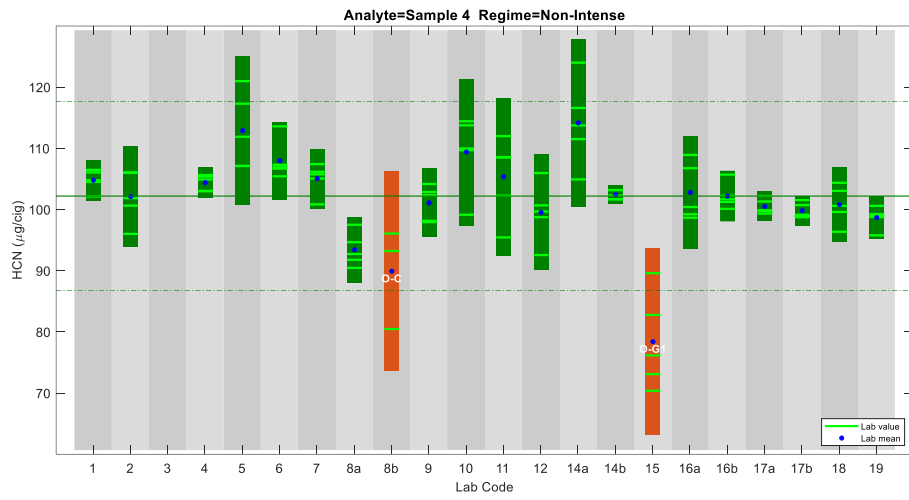
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	KR 2R5F	20	10		KR 2R5F	20	10
	Sample 1	20	10		Sample 1	20	10
	Sample 2	20	10		Sample 2	20	10
	Sample 3	20	10		Sample 3	20	10
	Sample 4	20	10		Sample 4	20	10
8a	CM 9	4~5	2~3	17a	CM 9	10	5
	KR 1R6F	4~5	2~3		KR 1R6F	10	5
	KR 2R5F	4~5	2~3		KR 2R5F	10	5
	Sample 1	4~5	2~3		Sample 1	10	5
	Sample 2	4~5	2~3		Sample 2	10	5
	Sample 3	4~5	2~3		Sample 3	10	5
	Sample 4	4~5	2~3		Sample 4	10	5
8b	CM 9	20	5	17b	CM 9	20	10
	KR 1R6F	19~20	5		KR 1R6F	20	10
	KR 2R5F	19~20	5		KR 2R5F	20	10
	Sample 1	19~20	5		Sample 1	20	10
	Sample 2	20	5		Sample 2	20	10
	Sample 3	20	5		Sample 3	20	10
	Sample 4	20	5		Sample 4	20	10
9	CM 9	20	10	18	CM 9	20	10
	KR 1R6F	20	10		KR 1R6F	20	10
	KR 2R5F	20	10		KR 2R5F	20	10
	Sample 1	20	10		Sample 1	20	10
	Sample 2	20	10		Sample 2	20	10
	Sample 3	20	10		Sample 3	20	10
	Sample 4	20	10		Sample 4	20	10
10	CM 9	20	10	19	CM 9	20	10
	KR 1R6F	20	10		KR 1R6F	20	10
	KR 2R5F	20	10		KR 2R5F	20	10
	Sample 1	20	10		Sample 1	20	10
	Sample 2	20	10		Sample 2	20	10
	Sample 3	20	10		Sample 3	20	10
	Sample 4	20	10		Sample 4	20	10
11	CM 9	20	10				

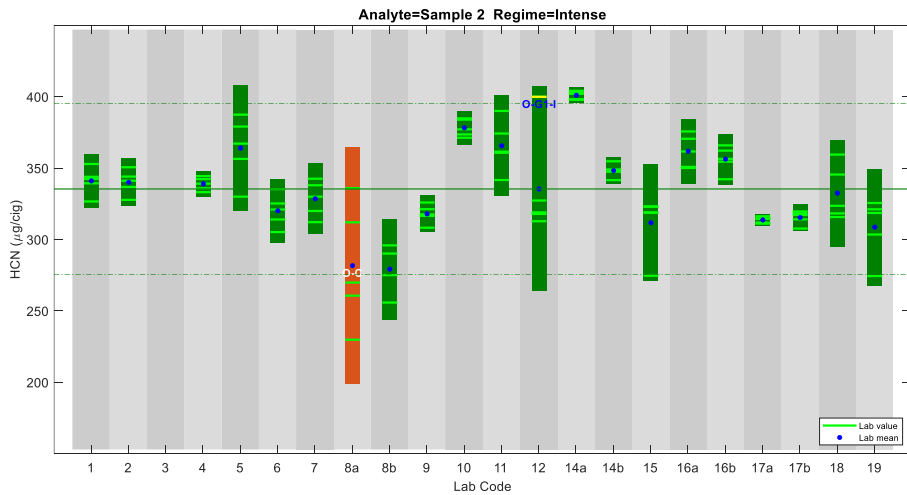
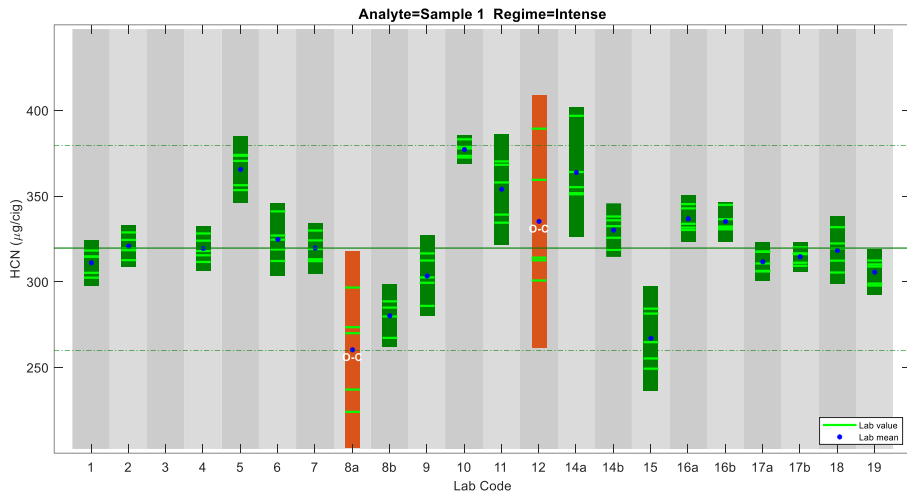
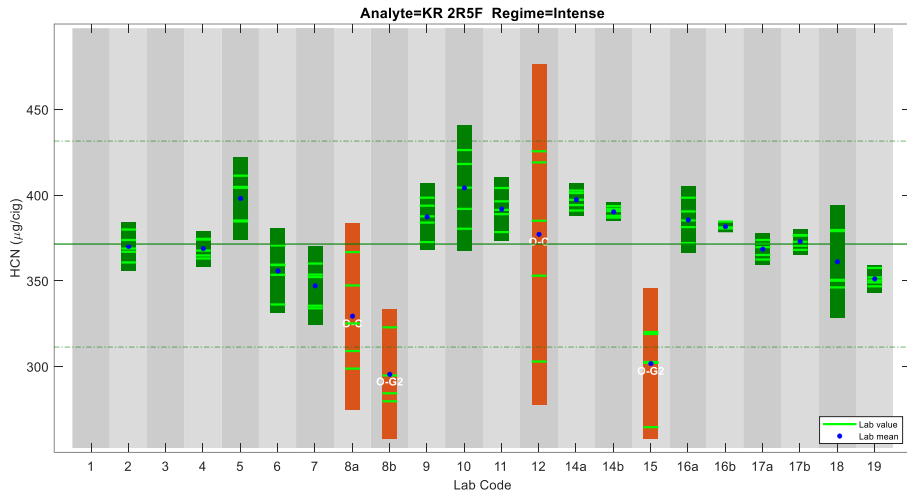
Lab code	Sample	ISO 3308	ISO 20778	Lab code	Sample	ISO 3308	ISO 20778
	KR 1R6F	20	10				
	KR 2R5F	20	10				
	Sample 1	20	10				
	Sample 2	20	10				
	Sample 3	20	10				
	Sample 4	20	10				

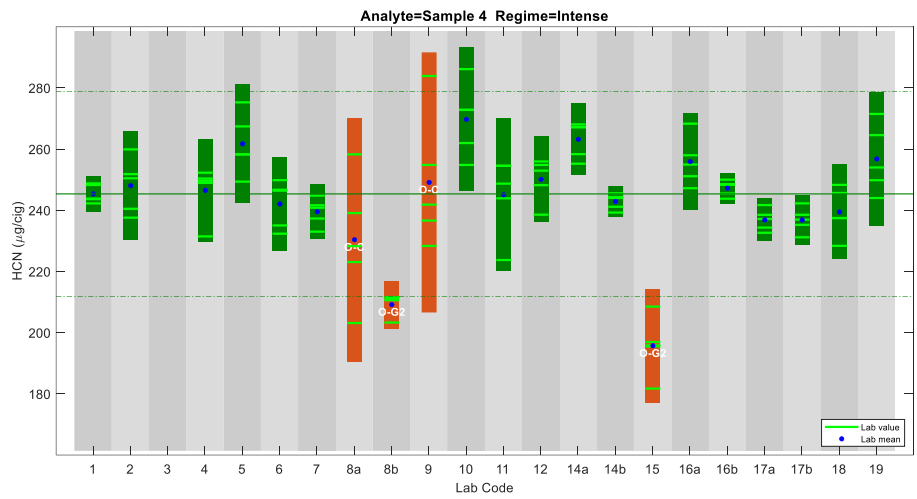
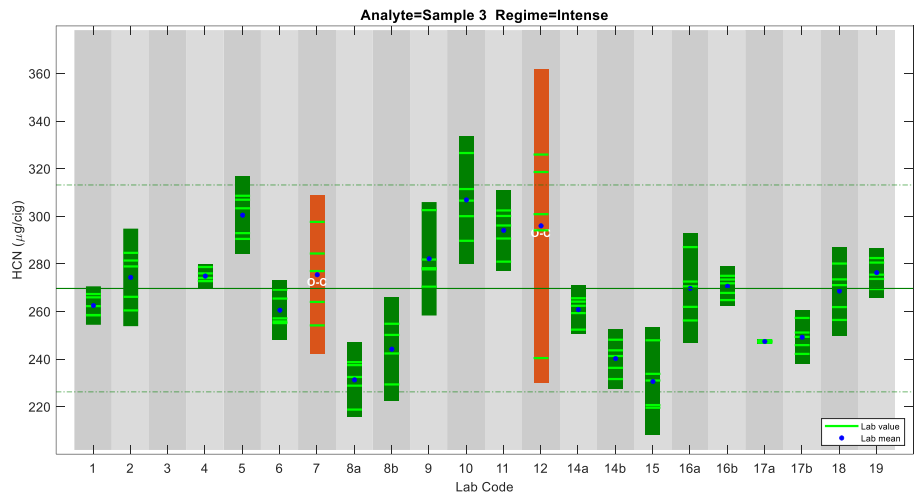
Appendix D - Data Graphs











Where O-C means outlier detected by Cochran's test, O-G1 means outlier detected by single Grubbs' test, O-G2 means outlier detected by paired Grubbs' test, O-G1-I means individual outlying value detected by single Grubbs' test

Appendix E - Method Details

Table E1. Detailed information on smoking step

Lab code	Subtype	Smoking Machine Style	Make
1	Pad+Pad	Linear	Cerulean SM450
2	Pad+Pad	Rotary	Borgwaldt RM-200A
3	Pad+Imp	Linear	Cerulean SM450
4	Pad+Pad	Rotary	RM20H
5	Pad+Pad	Linear	Cerulean SM450
6	Pad+Pad	Linear	Cerulean SM450
7	Pad+Pad	Linear	Cerulean SM450
8a	Pad+Pad	Linear	Cerulean SM450
8b	Pad+Pad	Rotary	Borgaldt RM20H
9	Pad+Pad	Linear	Cerulean SM450
10	Pad+Pad	Linear	Cerulean SM450
11	Pad+Pad	Linear	Cerulean SM450
12	Pad+Imp	Linear	Borgwaldt LX20
14a	Pad+Pad	Linear	Cerulean SM450
14b	Pad+Imp	Linear	Cerulean SM450
15	Pad+Imp	Linear	Borgwaldt LX20
16a	Pad+Pad	Linear	Cerulean SM450
16b	Pad+Imp	Linear	Cerulean SM450
17a	Pad+Pad	Rotary	Cerulean X200AH
17b	Pad+Pad	Linear	Cerulean SM450
18	Pad+Pad	Linear	Cerulean SM450
19	Pad+Pad	Linear	Cerulean SM450

Table E2. Trapping & Extraction- Particulate

Lab code	Filter Pad / Diameter	Extraction solvent	Extraction
1	one 44mm pad treated by NaOH + one 44 mm blank pad	0.1M NaOH	shake 30min
2	92mm pad (treated with NaOH solution) + 92 mm blank pad	0.1M NaOH	shake 30min
3	glass fiber filter / 44 mm	NA	NA
4	92mm pad treated with NaOH solution + 92mm blank pad	0.1 M NaOH	shake for 30min
5	44 mm pad (treated with NaOH solution) + 44 mm pad (blank)	0.1M NaOH	shake 30min

Lab code	Filter Pad / Diameter	Extraction solvent	Extraction
6	one 44mm pad treated by NaOH + one 44 mm blank pad	0.1M NaOH	shake 30min
7	one 44mm pad treated by NaOH + one 44 mm blank pad	0.1 M NaOH	shake for 30min
8a	CFP 44 mm	NA	NA
8b	92mm pad	NA	NA
9	one 44mm pad treated by NaOH + one 44 mm blank pad	0.1M NaOH	shake 30min
10	one 44mm pad treated by NaOH + one 44 mm blank pad	0.1M NaOH	shake 30min
11	44 mm pad (treated with NaOH solution) + 44 mm pad (blank)	0.1M NaOH	shake 30min
12	44mm CFP	0.1M NaOH	shake 30 min
14a	one 44mm pad treated by NaOH + one 44 mm blank pad	0.1M NaOH	shake 30min
14b	CFP 44 mm	0.1M NaOH	shake 30min
15	CFP 44 mm	0.1N NaOH	150 rpm 30 min
16a	one 44mm pad treated by NaOH + one 44 mm blank pad	0.1M NaOH	shake 30min
16b	CFP 44 mm	0.1M NaOH	shake 30min
17a	92mm pad (treated with NaOH solution) + 92mm pad (blank)	0.1M NaOH	shake 30min
17b	one treated pad + one blank pad	1.0M NaOH	shake 30 min
18	one 44mm pad treated by NaOH + one 44 mm blank pad	0.1M NaOH	shake 30min
19	one 44mm pad treated by NaOH + one 44 mm blank pad	0.1M NaOH	shake 30 min

Where NA = not applicable

Table E3. Trapping & Extraction – Gas Phase

Lab code	Gas phase trap
3	ISO 3308: 30 mL NaOH 0.1 M in glass impinger and straight stem. ISO 20778: 90 mL NaOH 0.1 M in glass impinger and straight stem.
12	Non-Fritted Glass Impinger
14b	70 mL for ISO 3308 and 250 mL for ISO 20778 in fritted stem glass impinger
15	70 mL glass impinger, fritted stem
16b	70 mL(ISO 3308) or 250 mL(ISO 20778) fritted stem glass impinger

Table E4. Analysis

	Instrument	Wavelength (nm)	LOQ (µg/cig)	LOD (µg/cig)	r ²
1	Seal AA3	600	6,28	2,09	0,9999
2	Seal AA3	600	1,59	0,48	0,9999
3	Seal AA3	600	Pad: 2,6 Imp: 10,4	Pad: 0,8 Imp: 3,2	0,9990~1,0000
4	Seal AA3	600	0,86	0,29	0,999
5	Alliance Futura2	600	6,07	1,82	0,9988
6	Seal AA3	600	1,13	0,34	0,9999
7	Seal AA3	600	1,73	0,52	0,9999
8a	Skalar	600	5,33	1,60	1,00
8b	Skalar	600	5,33	1,60	1,00
9	SKALAR, SAN++	600	4,91	1,47	0,9993
10	SKALAR SAN++	600	5,86	1,76	0,9991
11	Seal AA3	600	1,35	0,40	1,0000
12	Astoria 2 CFA	570	ISO: 4 HCl: 13	ISO=1 HCl=4	≥0,995
14a	Alliance FUTURA II	600	1,00	0,30	0,9992
14b	Alliance FUTURA II	600	0,87	0,26	0,9994
15	Seal AA3	630	1,02	0,34	1,00
16a	Seal AA3	600	1,55	0,47	0,9999
16b	Seal AA3	600	1,75	0,53	0,9999
17a	Seal AA3	600	1,49	0,49	0,9997
17b	Seal AA3	600	1,60	0,48	0,9999
18	Seal AA3	600	1,24	0,37	0,9998
19	FUTURAI AMS-ALLIANCE	600	1,09	0,32	0,9999

Where LOD = limit of detection, LOQ = limit of quantitation

Appendix F - Raw Data

Pad(treated)+Pad(blank)

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
1	CM 9	1	125,10	20	7,4	283,36	10	10,2
1	CM 9	2	126,44	20	8,1	315,28	10	10,4
1	CM 9	3	123,06	20	8,3	292,92	10	10,0
1	CM 9	4	124,45	20	7,6	283,60	10	10,9
1	CM 9	5	129,79	20	8,4	314,48	10	10,0
2	CM 9	1	141,17	10	7,9	325,93	5	10,3
2	CM 9	2	140,18	10	8,2	319,08	5	10,2
2	CM 9	3	131,15	10	8,0	314,00	5	10,1
2	CM 9	4	138,55	10	7,9	309,95	5	10,0
2	CM 9	5	139,20	10	8,0	324,38	5	10,4
4	CM 9	1	144,78	20	7,7	303,87	10	10,8
4	CM 9	2	137,60	20	7,6	299,98	10	10,7
4	CM 9	3	137,79	20	7,6	317,99	10	10,2
4	CM 9	4	146,04	20	7,6	309,44	10	9,9
4	CM 9	5	141,53	20	7,6	304,76	10	10,1
5	CM 9	1	150,77	20	7,7	321,70	10	10,3
5	CM 9	2	145,34	20	7,7	312,09	10	10,4
5	CM 9	3	149,77	20	7,7	335,42	10	10,6
5	CM 9	4	148,39	20	7,8	326,61	10	10,8
5	CM 9	5	148,39	20	7,7	310,95	10	10,7
6	CM 9	1	141,57	20	8,2	298,13	10	10,3
6	CM 9	2	132,75	20	7,9	284,47	10	10,2
6	CM 9	3	135,34	20	8,0	279,76	10	10,0
6	CM 9	4	140,15	20	7,5	308,03	10	9,5
6	CM 9	5	142,33	20	8,3	301,45	10	10,6
7	CM 9	1	129,14	20	7,3	307,46	10	11,0
7	CM 9	2	128,63	20	7,3	293,96	10	10,6
7	CM 9	3	132,40	20	7,8	279,33	10	9,9
7	CM 9	4	142,18	20	8,0	302,47	10	10,1
7	CM 9	5	143,00	20	7,8	307,77	10	11,3
8a	CM 9	1	142,83	5	8,0	275,42	3	11,0

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
8a	CM 9	2	140,15	5	7,9	300,17	3	10,7
8a	CM 9	3	131,05	4	8,0	255,86	2	10,7
8a	CM 9	4	135,47	5	8,0	277,70	3	10,7
8a	CM 9	5	130,95	5	8,0	269,38	3	10,7
8b	CM 9	1	142,85	20	7,2	272,50	5	10,6
8b	CM 9	2	134,95	20	7,2	269,90	5	10,7
8b	CM 9	3	125,33	20	7,1	297,98	5	10,0
8b	CM 9	4	NR	NR	NR	285,50	5	10,1
8b	CM 9	5	NR	NR	NR	NR	NR	NR
9	CM 9	1	142,09	20	7,6	295,31	10	10,2
9	CM 9	2	136,64	20	7,5	312,44	10	10,1
9	CM 9	3	137,72	20	7,8	303,10	10	9,6
9	CM 9	4	142,74	20	7,8	299,46	10	9,9
9	CM 9	5	138,12	20	7,6	299,98	10	9,2
10	CM 9	1	154,25	20	7,7	331,51	10	10,8
10	CM 9	2	154,64	20	7,8	322,50	10	10,6
10	CM 9	3	153,96	20	7,8	342,59	10	10,8
10	CM 9	4	154,12	20	7,9	332,62	10	10,8
10	CM 9	5	154,55	20	7,8	326,78	10	10,9
11	CM 9	1	141,77	20	8,3	311,88	10	12,0
11	CM 9	2	137,42	20	8,8	301,68	10	11,8
11	CM 9	3	129,84	20	8,2	328,24	10	11,8
11	CM 9	4	138,87	20	8,3	320,60	10	12,7
11	CM 9	5	142,87	20	8,7	295,12	10	12,6
14a	CM 9	1	158,68	20	7,6	326,18	10	11,0
14a	CM 9	2	163,86	20	7,5	330,76	10	10,9
14a	CM 9	3	163,21	20	7,7	333,12	10	10,4
14a	CM 9	4	159,73	20	7,6	340,61	10	11,3
14a	CM 9	5	159,67	20	7,5	334,22	10	10,6
16a	CM 9	1	140,45	20	8,0	299,75	10	10,7
16a	CM 9	2	140,73	20	7,8	306,56	10	10,5
16a	CM 9	3	143,68	20	7,3	310,43	10	10,6
16a	CM 9	4	136,77	20	7,4	311,24	10	10,8
16a	CM 9	5	138,65	20	7,6	312,32	10	10,7

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
17a	CM 9	1	142,35	10	7,8	293,83	5	10,4
17a	CM 9	2	140,30	10	7,8	292,62	5	8,2
17a	CM 9	3	137,22	10	7,7	300,87	5	10,2
17a	CM 9	4	134,23	10	7,8	304,68	5	10,5
17a	CM 9	5	137,95	10	7,6	301,72	5	10,3
17b	CM 9	1	144,75	20	7,7	297,88	10	10,4
17b	CM 9	2	142,52	20	7,7	294,52	10	8,3
17b	CM 9	3	135,97	20	7,6	306,77	10	10,3
17b	CM 9	4	135,19	20	7,8	306,26	10	10,3
17b	CM 9	5	139,44	20	7,5	298,71	10	10,3
18	CM 9	1	145,46	20	8,1	293,60	10	10,3
18	CM 9	2	134,33	20	8,1	284,83	10	10,3
18	CM 9	3	133,87	20	8,0	287,23	10	10,8
18	CM 9	4	130,45	20	8,4	302,45	10	10,2
18	CM 9	5	136,01	20	8,3	278,49	10	10,6
19	CM 9	1	143,07	20	7,9	285,80	10	10,0
19	CM 9	2	141,48	20	8,0	295,30	10	10,3
19	CM 9	3	140,05	20	8,1	286,83	10	10,2
19	CM 9	4	144,64	20	7,7	293,50	10	9,8
19	CM 9	5	137,13	20	7,5	295,04	10	10,4
1	KR 1R6F	1	NR	NR	NR	NR	NR	NR
1	KR 1R6F	2	NR	NR	NR	NR	NR	NR
1	KR 1R6F	3	NR	NR	NR	NR	NR	NR
1	KR 1R6F	4	NR	NR	NR	NR	NR	NR
1	KR 1R6F	5	NR	NR	NR	NR	NR	NR
2	KR 1R6F	1	97,36	10	8,1	365,27	5	8,2
2	KR 1R6F	2	99,15	10	8,1	382,19	5	8,3
2	KR 1R6F	3	96,51	10	7,8	372,54	5	8,3
2	KR 1R6F	4	100,10	10	7,8	384,27	5	8,4
2	KR 1R6F	5	95,37	10	8,2	379,60	5	8,4
4	KR 1R6F	1	94,33	20	7,5	392,68	10	8,3
4	KR 1R6F	2	100,71	20	7,3	418,52	10	8,2
4	KR 1R6F	3	96,64	20	7,2	416,39	10	8,6
4	KR 1R6F	4	98,55	20	7,6	395,79	10	8,1

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
4	KR 1R6F	5	95,68	20	7,5	406,67	10	8,4
5	KR 1R6F	1	107,77	20	7,5	410,33	10	8,2
5	KR 1R6F	2	101,38	20	7,4	453,83	10	8,0
5	KR 1R6F	3	106,28	20	7,4	434,87	10	7,9
5	KR 1R6F	4	113,10	20	7,6	447,21	10	8,4
5	KR 1R6F	5	102,90	20	7,5	422,29	10	7,9
6	KR 1R6F	1	91,28	20	7,1	398,04	10	7,5
6	KR 1R6F	2	103,02	20	7,2	362,18	10	7,3
6	KR 1R6F	3	97,38	20	6,9	391,03	10	7,6
6	KR 1R6F	4	98,21	20	7,3	383,64	10	7,7
6	KR 1R6F	5	92,84	20	6,8	366,36	10	7,3
7	KR 1R6F	1	97,03	20	7,7	368,80	10	8,1
7	KR 1R6F	2	103,26	20	7,7	397,97	10	8,4
7	KR 1R6F	3	98,43	20	7,3	408,56	10	8,2
7	KR 1R6F	4	96,72	20	7,4	411,77	10	8,8
7	KR 1R6F	5	100,87	20	7,6	415,82	10	8,1
8a	KR 1R6F	1	91,35	5	7,9	322,52	3	9,7
8a	KR 1R6F	2	91,94	5	8,0	369,44	3	9,0
8a	KR 1R6F	3	91,01	4	7,8	301,62	2	9,0
8a	KR 1R6F	4	99,59	5	7,6	334,56	3	9,2
8a	KR 1R6F	5	88,59	5	7,6	301,28	3	8,9
8b	KR 1R6F	1	89,91	19	7,2	330,22	5	8,4
8b	KR 1R6F	2	104,14	20	7,3	321,90	5	8,5
8b	KR 1R6F	3	80,35	20	7,2	327,10	5	8,5
8b	KR 1R6F	4	NR	NR	NR	334,90	5	8,5
8b	KR 1R6F	5	NR	NR	NR	NR	NR	NR
9	KR 1R6F	1	97,86	20	6,9	404,82	10	8,3
9	KR 1R6F	2	97,45	20	7,2	426,62	10	7,8
9	KR 1R6F	3	95,38	20	7,0	394,44	10	8,1
9	KR 1R6F	4	93,82	20	7,0	411,05	10	8,0
9	KR 1R6F	5	94,74	20	7,1	384,06	10	7,6
10	KR 1R6F	1	98,72	20	7,0	454,17	10	8,3
10	KR 1R6F	2	108,78	20	7,2	466,58	10	8,2
10	KR 1R6F	3	98,79	20	7,0	445,34	10	8,1

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
10	KR 1R6F	4	103,88	20	7,4	465,33	10	8,6
10	KR 1R6F	5	106,10	20	7,2	445,58	10	8,0
11	KR 1R6F	1	84,46	20	8,0	386,48	10	8,9
11	KR 1R6F	2	79,47	20	7,9	441,08	10	8,8
11	KR 1R6F	3	89,42	20	8,0	424,40	10	9,0
11	KR 1R6F	4	87,22	20	7,8	429,08	10	9,3
11	KR 1R6F	5	89,45	20	7,9	399,00	10	9,1
14a	KR 1R6F	1	100,32	20	7,8	433,98	10	8,1
14a	KR 1R6F	2	102,15	20	7,3	433,87	10	8,7
14a	KR 1R6F	3	100,23	20	7,4	429,78	10	8,5
14a	KR 1R6F	4	98,93	20	7,3	433,23	10	8,9
14a	KR 1R6F	5	94,96	20	7,3	440,65	10	8,1
16a	KR 1R6F	1	99,35	20	7,4	401,94	10	8,5
16a	KR 1R6F	2	98,77	20	7,5	408,22	10	8,3
16a	KR 1R6F	3	95,31	20	7,4	425,08	10	8,3
16a	KR 1R6F	4	91,04	20	7,3	400,56	10	8,4
16a	KR 1R6F	5	97,56	20	7,5	412,28	10	8,2
17a	KR 1R6F	1	92,71	10	7,1	379,11	5	8,2
17a	KR 1R6F	2	91,91	10	7,2	378,44	5	8,1
17a	KR 1R6F	3	92,06	10	7,4	382,25	5	8,1
17a	KR 1R6F	4	92,80	10	7,5	389,03	5	8,0
17a	KR 1R6F	5	92,17	10	7,4	379,67	5	8,1
17b	KR 1R6F	1	93,02	20	7,3	382,47	10	8,1
17b	KR 1R6F	2	92,77	20	7,1	372,13	10	8,3
17b	KR 1R6F	3	93,01	20	7,4	395,61	10	8,3
17b	KR 1R6F	4	92,34	20	7,4	395,87	10	8,1
17b	KR 1R6F	5	93,54	20	7,5	389,25	10	8,2
18	KR 1R6F	1	89,20	20	7,6	393,62	10	8,7
18	KR 1R6F	2	92,24	20	7,6	375,00	10	8,4
18	KR 1R6F	3	99,38	20	7,5	368,20	10	8,1
18	KR 1R6F	4	91,89	20	7,5	375,90	10	8,3
18	KR 1R6F	5	97,68	20	7,4	361,23	10	8,4
19	KR 1R6F	1	100,05	20	7,0	381,69	10	8,3
19	KR 1R6F	2	97,95	20	7,1	397,00	10	8,4

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
19	KR 1R6F	3	93,69	20	6,8	393,22	10	8,1
19	KR 1R6F	4	94,20	20	6,9	376,38	10	8,0
19	KR 1R6F	5	96,54	20	6,6	362,39	10	7,7
1	KR 2R5F	1	NR	NR	NR	NR	NR	NR
1	KR 2R5F	2	NR	NR	NR	NR	NR	NR
1	KR 2R5F	3	NR	NR	NR	NR	NR	NR
1	KR 2R5F	4	NR	NR	NR	NR	NR	NR
1	KR 2R5F	5	NR	NR	NR	NR	NR	NR
2	KR 2R5F	1	12,30	10	8,2	367,04	5	7,1
2	KR 2R5F	2	13,68	10	8,3	360,81	5	7,0
2	KR 2R5F	3	11,63	10	8,1	368,91	5	7,1
2	KR 2R5F	4	11,91	10	7,9	373,89	5	7,3
2	KR 2R5F	5	14,35	10	8,3	380,01	5	7,3
4	KR 2R5F	1	11,58	20	8,0	374,15	10	6,9
4	KR 2R5F	2	15,40	20	7,9	363,11	10	7,5
4	KR 2R5F	3	15,49	20	7,8	364,87	10	7,5
4	KR 2R5F	4	11,47	20	7,9	367,74	10	7,5
4	KR 2R5F	5	14,03	20	7,6	374,56	10	7,5
5	KR 2R5F	1	15,89	20	7,5	384,74	10	7,6
5	KR 2R5F	2	15,45	20	7,6	385,30	10	7,3
5	KR 2R5F	3	15,61	20	7,3	411,43	10	7,3
5	KR 2R5F	4	15,39	20	7,5	404,36	10	7,3
5	KR 2R5F	5	15,42	20	7,5	404,88	10	7,3
6	KR 2R5F	1	12,57	20	7,6	336,28	10	6,9
6	KR 2R5F	2	13,48	20	7,3	359,25	10	7,0
6	KR 2R5F	3	11,68	20	7,8	370,70	10	6,9
6	KR 2R5F	4	12,93	20	7,8	353,59	10	7,0
6	KR 2R5F	5	13,34	20	7,7	359,51	10	6,8
7	KR 2R5F	1	13,02	20	8,0	353,72	10	7,4
7	KR 2R5F	2	11,12	20	7,6	352,26	10	7,3
7	KR 2R5F	3	11,37	20	7,6	334,03	10	7,7
7	KR 2R5F	4	11,55	20	7,5	335,55	10	7,3
7	KR 2R5F	5	12,76	20	7,7	360,15	10	7,4
8a	KR 2R5F	1	15,29	5	7,9	309,10	3	7,7

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
8a	KR 2R5F	2	13,52	5	8,1	366,85	3	8,0
8a	KR 2R5F	3	11,96	4	8,5	347,39	2	7,9
8a	KR 2R5F	4	13,19	5	8,9	325,20	3	7,5
8a	KR 2R5F	5	11,72	5	8,7	298,85	3	8,3
8b	KR 2R5F	1	14,10	19	7,4	279,78	5	7,3
8b	KR 2R5F	2	10,92	20	7,5	294,86	5	7,0
8b	KR 2R5F	3	10,01	20	7,5	322,94	5	7,3
8b	KR 2R5F	4	NR	NR	NR	284,46	5	7,4
8b	KR 2R5F	5	NR	NR	NR	NR	NR	NR
9	KR 2R5F	1	11,71	20	7,8	393,92	10	7,3
9	KR 2R5F	2	12,53	20	8,0	398,59	10	7,3
9	KR 2R5F	3	11,86	20	7,9	387,69	10	6,9
9	KR 2R5F	4	11,16	20	7,8	384,06	10	7,1
9	KR 2R5F	5	12,72	20	7,6	372,64	10	7,0
10	KR 2R5F	1	12,36	20	7,7	380,48	10	7,8
10	KR 2R5F	2	13,02	20	8,0	392,07	10	7,8
10	KR 2R5F	3	12,09	20	7,8	426,38	10	7,5
10	KR 2R5F	4	12,82	20	8,0	404,47	10	7,7
10	KR 2R5F	5	12,62	20	7,8	418,27	10	7,6
11	KR 2R5F	1	11,44	20	8,7	389,00	10	8,2
11	KR 2R5F	2	11,25	20	8,9	378,52	10	8,5
11	KR 2R5F	3	9,18	20	8,5	396,48	10	8,4
11	KR 2R5F	4	9,81	20	8,9	404,24	10	7,9
11	KR 2R5F	5	11,20	20	8,6	391,48	10	8,4
14a	KR 2R5F	1	11,80	20	7,9	397,35	10	7,6
14a	KR 2R5F	2	10,81	20	8,0	402,76	10	7,6
14a	KR 2R5F	3	11,62	20	7,6	394,32	10	7,5
14a	KR 2R5F	4	12,08	20	7,7	391,12	10	7,5
14a	KR 2R5F	5	12,49	20	7,5	401,35	10	7,5
16a	KR 2R5F	1	13,01	20	8,0	381,43	10	7,9
16a	KR 2R5F	2	12,91	20	7,5	372,09	10	7,8
16a	KR 2R5F	3	12,75	20	7,2	398,60	10	7,5
16a	KR 2R5F	4	13,48	20	7,6	385,32	10	7,4
16a	KR 2R5F	5	13,86	20	7,5	390,56	10	7,5

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
17a	KR 2R5F	1	13,27	10	7,6	365,15	5	7,3
17a	KR 2R5F	2	13,44	10	7,2	362,49	5	7,4
17a	KR 2R5F	3	13,47	10	7,6	373,91	5	7,2
17a	KR 2R5F	4	13,27	10	7,8	369,74	5	7,2
17a	KR 2R5F	5	13,60	10	7,7	371,62	5	7,4
17b	KR 2R5F	1	13,06	20	7,5	370,57	10	7,2
17b	KR 2R5F	2	14,04	20	7,1	368,13	10	7,3
17b	KR 2R5F	3	13,69	20	7,5	372,87	10	7,4
17b	KR 2R5F	4	12,87	20	7,7	376,47	10	7,3
17b	KR 2R5F	5	13,78	20	7,6	376,74	10	7,5
18	KR 2R5F	1	12,93	20	7,8	346,24	10	7,2
18	KR 2R5F	2	14,20	20	7,6	379,09	10	6,9
18	KR 2R5F	3	13,95	20	7,6	350,14	10	7,2
18	KR 2R5F	4	14,75	20	7,3	350,67	10	7,4
18	KR 2R5F	5	14,95	20	7,9	379,73	10	7,6
19	KR 2R5F	1	13,20	20	7,7	350,34	10	6,9
19	KR 2R5F	2	12,19	20	7,6	346,87	10	7,2
19	KR 2R5F	3	13,99	20	7,4	352,08	10	6,7
19	KR 2R5F	4	13,53	20	7,5	357,59	10	7,1
19	KR 2R5F	5	13,50	20	7,8	349,16	10	7,3
1	Sample 1	1	33,45	20	6,3	318,28	10	7,0
1	Sample 1	2	30,91	20	6,1	314,80	10	7,0
1	Sample 1	3	28,92	20	6,0	314,66	10	7,6
1	Sample 1	4	28,80	20	6,0	302,44	10	7,0
1	Sample 1	5	24,45	20	6,6	305,28	10	7,7
2	Sample 1	1	30,13	10	7,0	324,48	5	7,1
2	Sample 1	2	27,25	10	7,0	318,46	5	7,1
2	Sample 1	3	27,04	10	7,0	319,60	5	7,0
2	Sample 1	4	26,97	10	6,8	312,65	5	7,0
2	Sample 1	5	25,46	10	7,1	328,84	5	7,3
4	Sample 1	1	31,71	20	6,4	317,99	10	7,5
4	Sample 1	2	30,67	20	6,5	315,50	10	7,0
4	Sample 1	3	27,20	20	6,2	324,02	10	7,5
4	Sample 1	4	27,76	20	6,5	311,59	10	7,3

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
4	Sample 1	5	28,71	20	6,0	328,22	10	7,2
5	Sample 1	1	27,56	20	6,4	373,56	10	7,1
5	Sample 1	2	26,98	20	6,3	370,58	10	7,2
5	Sample 1	3	25,80	20	6,1	374,05	10	7,2
5	Sample 1	4	24,22	20	6,4	353,54	10	7,4
5	Sample 1	5	24,62	20	6,4	356,40	10	7,1
6	Sample 1	1	23,54	20	6,3	327,02	10	7,5
6	Sample 1	2	25,31	20	6,1	312,15	10	7,1
6	Sample 1	3	22,08	20	6,2	324,62	10	7,2
6	Sample 1	4	21,75	20	6,5	318,89	10	7,0
6	Sample 1	5	20,92	20	6,0	341,12	10	7,4
7	Sample 1	1	28,00	20	6,6	329,94	10	7,0
7	Sample 1	2	25,02	20	6,1	312,06	10	7,4
7	Sample 1	3	26,83	20	6,3	313,20	10	7,3
7	Sample 1	4	25,53	20	6,1	319,15	10	7,4
7	Sample 1	5	28,08	20	6,6	324,17	10	7,1
8a	Sample 1	1	24,50	5	6,0	296,69	3	8,0
8a	Sample 1	2	24,70	5	6,5	270,03	3	7,5
8a	Sample 1	3	29,93	4	6,6	224,14	2	7,0
8a	Sample 1	4	28,60	5	6,9	237,14	3	6,9
8a	Sample 1	5	28,69	5	6,8	273,54	3	7,7
8b	Sample 1	1	27,79	19	6,0	279,78	5	7,5
8b	Sample 1	2	24,44	20	6,1	267,30	5	7,3
8b	Sample 1	3	27,30	20	6,1	284,98	5	7,2
8b	Sample 1	4	NR	NR	NR	288,62	5	7,4
8b	Sample 1	5	NR	NR	NR	NR	NR	NR
9	Sample 1	1	25,72	20	6,0	316,59	10	7,1
9	Sample 1	2	26,54	20	6,1	299,46	10	7,1
9	Sample 1	3	25,32	20	5,7	302,58	10	7,3
9	Sample 1	4	26,21	20	6,0	285,97	10	6,8
9	Sample 1	5	24,06	20	5,8	312,44	10	6,8
10	Sample 1	1	29,18	20	6,1	378,84	10	7,4
10	Sample 1	2	27,03	20	6,1	383,16	10	7,4
10	Sample 1	3	27,70	20	6,3	377,81	10	7,4

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
10	Sample 1	4	28,08	20	6,2	372,55	10	7,4
10	Sample 1	5	31,50	20	6,1	373,56	10	7,2
11	Sample 1	1	21,28	20	7,0	368,28	10	8,6
11	Sample 1	2	22,14	20	7,2	358,00	10	8,9
11	Sample 1	3	21,77	20	7,2	370,28	10	8,5
11	Sample 1	4	22,64	20	7,2	334,52	10	9,4
11	Sample 1	5	20,72	20	7,0	339,24	10	8,0
14a	Sample 1	1	26,80	20	6,5	351,12	10	7,2
14a	Sample 1	2	27,42	20	6,3	396,91	10	7,8
14a	Sample 1	3	26,65	20	6,0	355,25	10	7,5
14a	Sample 1	4	27,41	20	6,5	364,09	10	7,4
14a	Sample 1	5	27,17	20	6,3	351,75	10	7,5
16a	Sample 1	1	28,53	20	6,3	331,65	10	7,8
16a	Sample 1	2	29,84	20	6,1	342,87	10	7,3
16a	Sample 1	3	30,71	20	5,8	333,86	10	7,1
16a	Sample 1	4	29,05	20	6,2	345,36	10	7,2
16a	Sample 1	5	31,63	20	6,1	330,25	10	7,0
17a	Sample 1	1	25,95	10	6,1	306,05	5	7,1
17a	Sample 1	2	26,08	10	6,2	310,72	5	7,2
17a	Sample 1	3	26,88	10	6,1	306,39	5	7,2
17a	Sample 1	4	25,87	10	6,3	317,71	5	7,3
17a	Sample 1	5	26,60	10	6,3	317,52	5	7,2
17b	Sample 1	1	25,64	20	6,0	309,37	10	7,2
17b	Sample 1	2	26,55	20	6,3	316,15	10	7,1
17b	Sample 1	3	25,97	20	6,2	316,66	10	7,1
17b	Sample 1	4	26,14	20	6,3	311,15	10	7,2
17b	Sample 1	5	26,89	20	6,2	320,15	10	7,3
18	Sample 1	1	24,78	20	6,1	312,36	10	7,5
18	Sample 1	2	27,19	20	6,1	322,40	10	7,8
18	Sample 1	3	27,26	20	6,2	331,90	10	7,9
18	Sample 1	4	25,07	20	6,7	305,44	10	7,6
18	Sample 1	5	26,59	20	6,1	319,55	10	7,5
19	Sample 1	1	24,10	20	6,1	308,95	10	7,4
19	Sample 1	2	24,46	20	6,2	312,45	10	7,9

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
19	Sample 1	3	25,67	20	6,1	298,99	10	7,1
19	Sample 1	4	27,63	20	6,1	310,18	10	7,5
19	Sample 1	5	24,87	20	5,9	297,86	10	7,9
1	Sample 2	1	51,67	20	6,1	339,36	10	7,1
1	Sample 2	2	53,54	20	6,1	343,92	10	7,7
1	Sample 2	3	54,72	20	6,0	326,66	10	7,6
1	Sample 2	4	52,84	20	6,0	352,92	10	7,6
1	Sample 2	5	55,83	20	5,8	342,44	10	7,5
2	Sample 2	1	56,21	10	6,4	336,83	5	6,9
2	Sample 2	2	67,96	10	6,9	350,64	5	7,2
2	Sample 2	3	54,86	10	6,5	341,19	5	7,2
2	Sample 2	4	42,71	10	6,2	327,80	5	7,0
2	Sample 2	5	51,56	10	6,4	344,10	5	7,4
4	Sample 2	1	56,80	20	6,1	339,13	10	7,5
4	Sample 2	2	53,08	20	6,1	333,18	10	7,3
4	Sample 2	3	49,80	20	5,9	344,41	10	7,1
4	Sample 2	4	50,44	20	5,8	335,89	10	7,4
4	Sample 2	5	57,84	20	6,0	342,33	10	7,1
5	Sample 2	1	60,35	20	6,0	379,11	10	7,1
5	Sample 2	2	56,82	20	6,0	387,44	10	7,1
5	Sample 2	3	48,82	20	6,0	356,48	10	7,0
5	Sample 2	4	56,99	20	6,3	330,03	10	7,4
5	Sample 2	5	55,81	20	6,0	367,19	10	7,2
6	Sample 2	1	57,05	20	6,1	314,05	10	7,0
6	Sample 2	2	50,68	20	6,0	325,24	10	7,1
6	Sample 2	3	53,54	20	6,1	305,24	10	7,2
6	Sample 2	4	52,11	20	5,9	321,03	10	7,1
6	Sample 2	5	54,76	20	6,3	335,31	10	6,9
7	Sample 2	1	52,20	20	5,9	342,58	10	7,2
7	Sample 2	2	52,80	20	5,9	330,02	10	7,3
7	Sample 2	3	55,12	20	6,0	320,02	10	7,4
7	Sample 2	4	52,47	20	6,0	312,16	10	7,6
7	Sample 2	5	51,05	20	6,0	338,01	10	7,4
8a	Sample 2	1	53,40	5	6,2	312,05	3	7,9

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
8a	Sample 2	2	49,19	5	6,0	335,96	3	7,8
8a	Sample 2	3	48,62	4	6,3	229,86	2	7,5
8a	Sample 2	4	56,13	5	6,6	269,90	3	7,1
8a	Sample 2	5	48,17	5	6,0	260,71	3	7,4
8b	Sample 2	1	50,96	20	5,8	295,90	5	7,6
8b	Sample 2	2	56,64	20	5,9	275,10	5	7,0
8b	Sample 2	3	50,96	20	5,7	290,18	5	7,5
8b	Sample 2	4	NR	NR	NR	255,86	5	7,2
8b	Sample 2	5	NR	NR	NR	NR	NR	NR
9	Sample 2	1	48,19	20	5,8	316,59	10	6,9
9	Sample 2	2	49,96	20	5,8	325,93	10	7,0
9	Sample 2	3	56,83	20	6,2	308,29	10	6,8
9	Sample 2	4	48,71	20	5,8	317,63	10	7,1
9	Sample 2	5	48,71	20	5,7	321,26	10	6,7
10	Sample 2	1	59,15	20	6,0	383,97	10	7,3
10	Sample 2	2	62,12	20	6,1	384,84	10	7,4
10	Sample 2	3	59,55	20	6,1	371,27	10	7,1
10	Sample 2	4	54,74	20	6,2	377,17	10	7,6
10	Sample 2	5	57,10	20	6,1	373,61	10	7,4
11	Sample 2	1	46,75	20	7,0	374,24	10	8,8
11	Sample 2	2	50,00	20	7,0	390,04	10	9,7
11	Sample 2	3	53,33	20	7,0	341,68	10	9,0
11	Sample 2	4	46,42	20	7,0	361,54	10	9,5
11	Sample 2	5	47,48	20	7,0	360,76	10	8,6
14a	Sample 2	1	60,28	20	6,0	402,76	10	7,4
14a	Sample 2	2	62,01	20	6,2	398,29	10	7,5
14a	Sample 2	3	59,94	20	5,9	397,88	10	7,0
14a	Sample 2	4	59,98	20	6,0	402,07	10	8,0
14a	Sample 2	5	62,01	20	6,0	404,14	10	7,6
16a	Sample 2	1	52,93	20	6,0	350,88	10	7,2
16a	Sample 2	2	50,93	20	6,0	350,09	10	7,4
16a	Sample 2	3	56,23	20	5,8	370,56	10	7,7
16a	Sample 2	4	47,76	20	6,0	361,68	10	7,3
16a	Sample 2	5	48,69	20	6,0	375,68	10	7,2

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
17a	Sample 2	1	49,26	10	5,9	311,16	5	7,3
17a	Sample 2	2	49,49	10	5,9	311,89	5	7,1
17a	Sample 2	3	51,23	10	6,0	314,57	5	7,2
17a	Sample 2	4	51,12	10	5,9	316,27	5	7,1
17a	Sample 2	5	49,58	10	6,0	314,76	5	7,1
17b	Sample 2	1	50,01	20	5,8	317,18	10	7,3
17b	Sample 2	2	50,12	20	5,8	307,69	10	7,1
17b	Sample 2	3	50,73	20	6,1	314,13	10	7,4
17b	Sample 2	4	50,32	20	5,7	319,67	10	7,2
17b	Sample 2	5	49,05	20	6,0	318,36	10	7,2
18	Sample 2	1	50,88	20	6,3	318,32	10	7,7
18	Sample 2	2	50,28	20	6,8	323,62	10	7,2
18	Sample 2	3	49,54	20	6,4	315,76	10	7,2
18	Sample 2	4	54,99	20	6,8	359,49	10	7,9
18	Sample 2	5	52,38	20	6,8	345,52	10	7,6
19	Sample 2	1	58,06	20	6,1	274,43	10	7,4
19	Sample 2	2	50,21	20	6,0	325,59	10	7,1
19	Sample 2	3	50,19	20	5,9	303,52	10	7,2
19	Sample 2	4	49,00	20	5,9	318,62	10	7,5
19	Sample 2	5	55,00	20	6,0	321,18	10	7,8
1	Sample 3	1	79,03	20	6,0	262,24	10	8,3
1	Sample 3	2	89,27	20	6,5	267,32	10	8,1
1	Sample 3	3	89,92	20	6,2	258,49	10	8,2
1	Sample 3	4	83,15	20	6,1	265,92	10	8,1
1	Sample 3	5	83,60	20	6,0	258,40	10	8,4
2	Sample 3	1	79,74	10	6,3	281,40	5	7,8
2	Sample 3	2	85,25	10	6,7	278,91	5	7,8
2	Sample 3	3	74,58	10	6,4	266,14	5	7,7
2	Sample 3	4	74,66	10	6,2	260,43	5	7,7
2	Sample 3	5	81,09	10	6,4	284,62	5	7,9
4	Sample 3	1	80,41	20	6,1	278,67	10	8,2
4	Sample 3	2	83,61	20	6,3	272,72	10	8,2
4	Sample 3	3	87,48	20	6,4	274,08	10	8,0
4	Sample 3	4	85,13	20	6,3	276,00	10	8,1

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
4	Sample 3	5	79,62	20	6,0	272,86	10	8,0
5	Sample 3	1	98,55	20	6,2	303,34	10	8,2
5	Sample 3	2	92,05	20	6,3	306,94	10	7,8
5	Sample 3	3	95,85	20	6,1	308,61	10	7,8
5	Sample 3	4	102,39	20	6,2	290,48	10	7,3
5	Sample 3	5	100,00	20	6,2	292,90	10	7,5
6	Sample 3	1	82,91	20	6,3	257,10	10	8,2
6	Sample 3	2	80,62	20	6,2	265,42	10	8,2
6	Sample 3	3	81,69	20	6,0	255,80	10	8,5
6	Sample 3	4	73,44	20	6,1	255,11	10	7,9
6	Sample 3	5	81,42	20	6,0	269,15	10	7,8
7	Sample 3	1	86,20	20	6,5	284,34	10	8,4
7	Sample 3	2	83,24	20	6,1	264,00	10	8,1
7	Sample 3	3	83,43	20	6,1	254,14	10	8,9
7	Sample 3	4	80,39	20	6,0	297,63	10	8,3
7	Sample 3	5	77,52	20	6,0	276,97	10	8,0
8a	Sample 3	1	79,37	5	6,1	237,44	3	9,3
8a	Sample 3	2	74,63	5	6,5	238,70	3	8,5
8a	Sample 3	3	84,01	4	6,7	232,46	2	8,3
8a	Sample 3	4	82,10	5	6,6	218,76	3	8,5
8a	Sample 3	5	76,14	5	6,4	228,82	3	8,2
8b	Sample 3	1	85,16	20	5,9	254,82	5	8,0
8b	Sample 3	2	78,66	20	6,0	250,14	5	7,8
8b	Sample 3	3	69,95	20	5,8	229,34	5	7,8
8b	Sample 3	4	NR	NR	NR	242,34	5	7,3
8b	Sample 3	5	NR	NR	NR	NR	NR	NR
9	Sample 3	1	85,26	20	5,9	281,82	10	7,7
9	Sample 3	2	80,19	20	5,8	302,58	10	7,6
9	Sample 3	3	86,93	20	6,0	270,40	10	7,2
9	Sample 3	4	81,88	20	5,9	278,18	10	7,3
9	Sample 3	5	85,77	20	5,8	277,67	10	7,3
10	Sample 3	1	98,41	20	6,1	306,56	10	8,3
10	Sample 3	2	95,53	20	6,2	311,43	10	7,9
10	Sample 3	3	94,33	20	5,9	326,57	10	7,9

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
10	Sample 3	4	98,87	20	6,0	300,03	10	7,6
10	Sample 3	5	98,39	20	6,1	289,68	10	7,7
11	Sample 3	1	84,45	20	7,0	300,12	10	9,4
11	Sample 3	2	82,76	20	6,8	302,44	10	9,3
11	Sample 3	3	79,02	20	6,8	290,64	10	9,6
11	Sample 3	4	77,55	20	6,9	280,92	10	9,0
11	Sample 3	5	82,34	20	6,8	296,12	10	9,3
14a	Sample 3	1	93,80	20	6,1	265,56	10	8,5
14a	Sample 3	2	94,17	20	6,3	252,35	10	9,2
14a	Sample 3	3	95,94	20	6,6	259,31	10	8,4
14a	Sample 3	4	94,08	20	6,0	264,12	10	9,0
14a	Sample 3	5	95,01	20	6,0	262,38	10	8,4
16a	Sample 3	1	80,74	20	6,1	261,92	10	8,3
16a	Sample 3	2	86,57	20	5,9	287,04	10	8,1
16a	Sample 3	3	82,42	20	5,8	256,21	10	8,3
16a	Sample 3	4	79,83	20	6,2	272,56	10	8,3
16a	Sample 3	5	80,54	20	6,2	270,56	10	8,4
17a	Sample 3	1	76,97	10	6,0	246,83	5	8,1
17a	Sample 3	2	80,10	10	6,0	247,08	5	8,1
17a	Sample 3	3	76,85	10	6,2	247,47	5	8,0
17a	Sample 3	4	76,97	10	6,1	247,59	5	8,1
17a	Sample 3	5	78,49	10	6,2	247,92	5	7,9
17b	Sample 3	1	77,05	20	6,2	249,33	10	8,3
17b	Sample 3	2	81,08	20	6,1	245,85	10	8,2
17b	Sample 3	3	77,01	20	6,3	257,26	10	8,1
17b	Sample 3	4	76,73	20	6,3	242,16	10	8,2
17b	Sample 3	5	79,08	20	6,3	251,14	10	7,8
18	Sample 3	1	83,52	20	6,2	280,12	10	8,5
18	Sample 3	2	85,06	20	6,2	271,05	10	8,2
18	Sample 3	3	75,43	20	6,3	261,84	10	8,7
18	Sample 3	4	85,11	20	6,2	256,42	10	8,7
18	Sample 3	5	78,64	20	6,7	273,48	10	8,6
19	Sample 3	1	80,25	20	6,2	280,53	10	8,5
19	Sample 3	2	85,56	20	5,9	269,41	10	8,5

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
19	Sample 3	3	82,68	20	5,8	275,45	10	8,0
19	Sample 3	4	78,68	20	5,8	282,44	10	8,2
19	Sample 3	5	84,30	20	6,0	273,66	10	8,5
1	Sample 4	1	106,47	20	6,3	248,80	10	8,8
1	Sample 4	2	102,14	20	6,2	243,64	10	8,7
1	Sample 4	3	106,06	20	6,0	242,26	10	8,6
1	Sample 4	4	104,50	20	6,4	248,28	10	8,6
1	Sample 4	5	104,79	20	6,2	243,84	10	8,6
2	Sample 4	1	96,02	10	6,4	259,92	5	8,8
2	Sample 4	2	106,01	10	6,8	250,47	5	8,6
2	Sample 4	3	106,06	10	6,6	237,60	5	8,5
2	Sample 4	4	100,63	10	6,5	240,50	5	8,6
2	Sample 4	5	101,85	10	6,5	251,82	5	8,7
4	Sample 4	1	102,98	20	6,3	252,30	10	8,8
4	Sample 4	2	103,05	20	6,0	249,64	10	9,0
4	Sample 4	3	105,63	20	6,2	248,96	10	8,7
4	Sample 4	4	104,91	20	6,4	250,38	10	9,0
4	Sample 4	5	105,37	20	6,3	231,47	10	8,7
5	Sample 4	1	117,29	20	6,4	267,43	10	8,6
5	Sample 4	2	111,89	20	6,2	258,27	10	8,3
5	Sample 4	3	107,12	20	6,3	275,29	10	8,5
5	Sample 4	4	107,12	20	6,4	249,38	10	8,6
5	Sample 4	5	120,98	20	6,4	258,29	10	8,4
6	Sample 4	1	107,31	20	6,4	246,73	10	9,0
6	Sample 4	2	105,43	20	6,3	235,06	10	8,8
6	Sample 4	3	106,90	20	6,5	249,85	10	8,7
6	Sample 4	4	113,59	20	6,0	232,36	10	8,9
6	Sample 4	5	106,68	20	6,7	246,42	10	8,6
7	Sample 4	1	105,07	20	6,3	241,65	10	8,7
7	Sample 4	2	100,84	20	6,6	244,80	10	8,5
7	Sample 4	3	107,41	20	6,2	237,32	10	8,6
7	Sample 4	4	106,16	20	6,3	233,03	10	8,6
7	Sample 4	5	105,75	20	6,4	240,85	10	9,1
8a	Sample 4	1	94,66	5	6,5	258,29	3	9,0

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
8a	Sample 4	2	90,47	5	6,4	239,10	3	8,7
8a	Sample 4	3	97,51	4	6,7	223,10	2	8,9
8a	Sample 4	4	92,73	5	6,4	228,30	3	9,0
8a	Sample 4	5	91,79	5	6,5	203,16	3	10,3
8b	Sample 4	1	96,08	20	5,9	211,14	5	8,7
8b	Sample 4	2	93,22	20	6,0	211,66	5	8,6
8b	Sample 4	3	80,48	20	5,9	203,33	5	8,7
8b	Sample 4	4	NR	NR	NR	210,62	5	8,6
8b	Sample 4	5	NR	NR	NR	NR	NR	NR
9	Sample 4	1	104,17	20	5,8	254,83	10	8,7
9	Sample 4	2	102,35	20	6,1	283,89	10	8,7
9	Sample 4	3	97,94	20	5,8	228,36	10	8,1
9	Sample 4	4	102,87	20	6,0	241,85	10	8,2
9	Sample 4	5	98,16	20	6,0	236,66	10	8,3
10	Sample 4	1	99,15	20	6,1	286,15	10	8,9
10	Sample 4	2	114,41	20	6,2	261,98	10	8,8
10	Sample 4	3	109,98	20	6,2	272,86	10	8,7
10	Sample 4	4	109,68	20	6,1	254,83	10	8,8
10	Sample 4	5	113,75	20	6,2	272,81	10	8,7
11	Sample 4	1	111,99	20	7,0	254,52	10	9,8
11	Sample 4	2	102,26	20	7,2	254,56	10	10,7
11	Sample 4	3	95,44	20	7,1	248,72	10	9,8
11	Sample 4	4	108,57	20	7,0	243,92	10	10,3
11	Sample 4	5	108,49	20	6,8	223,76	10	10,2
14a	Sample 4	1	113,74	20	6,3	255,24	10	8,8
14a	Sample 4	2	104,92	20	6,1	258,36	10	9,2
14a	Sample 4	3	116,60	20	6,1	267,11	10	8,7
14a	Sample 4	4	111,50	20	6,3	267,25	10	9,0
14a	Sample 4	5	124,00	20	6,5	268,08	10	9,0
16a	Sample 4	1	100,41	20	6,1	247,22	10	8,7
16a	Sample 4	2	106,75	20	6,1	251,14	10	8,9
16a	Sample 4	3	108,92	20	6,0	254,97	10	8,8
16a	Sample 4	4	99,22	20	6,1	268,32	10	8,8
16a	Sample 4	5	98,66	20	6,0	257,98	10	8,9

Lab Code	Sample	Rep	ISO 3308			ISO 20778		
			Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)	Total HCN (µg/cig)	Cigs (/rep)	Puff Ct (/cig)
17a	Sample 4	1	99,73	10	6,1	237,18	5	8,6
17a	Sample 4	2	99,34	10	6,2	232,66	5	8,6
17a	Sample 4	3	101,31	10	6,2	238,52	5	8,6
17a	Sample 4	4	99,89	10	6,2	241,71	5	8,5
17a	Sample 4	5	102,21	10	6,1	234,37	5	8,3
17b	Sample 4	1	99,14	20	6,3	238,54	10	8,4
17b	Sample 4	2	98,74	20	6,3	235,25	10	8,5
17b	Sample 4	3	100,73	20	6,3	242,27	10	8,4
17b	Sample 4	4	98,94	20	6,2	236,97	10	8,4
17b	Sample 4	5	101,54	20	6,2	231,18	10	8,2
18	Sample 4	1	99,61	20	6,6	248,32	10	9,0
18	Sample 4	2	104,37	20	6,7	228,40	10	8,7
18	Sample 4	3	96,37	20	6,5	237,51	10	8,6
18	Sample 4	4	103,05	20	6,7	237,44	10	8,6
18	Sample 4	5	100,60	20	6,7	245,68	10	8,9
19	Sample 4	1	100,60	20	6,2	254,00	10	9,0
19	Sample 4	2	98,76	20	6,1	244,02	10	8,4
19	Sample 4	3	99,04	20	6,0	249,83	10	9,0
19	Sample 4	4	99,24	20	6,2	271,50	10	8,5
19	Sample 4	5	95,79	20	6,1	264,57	10	8,6

Pad+Imp

Lab Code	Sample	Rep	ISO 3308						ISO 20778					
			Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg /cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg /cig)
3	CM 9	1	140,79	47,48	93,31	4	8,0	17,80	333,73	69,36	264,37	2	10,4	52,75
3	CM 9	2	107,79	34,14	73,65	4	7,5	16,50	403,82	101,46	302,36	2	11,0	46,76
3	CM 9	3	150,09	56,26	93,83	4	8,0	18,10	449,58	101,79	347,79	2	10,8	45,56
3	CM 9	4	126,44	63,57	62,86	4	7,8	17,30	324,12	84,67	239,45	2	10,4	46,96
3	CM 9	5	137,22	70,06	67,15	4	7,9	17,90	383,59	107,44	276,15	2	10,3	51,66
12	CM 9	1	138,66	61,27	77,38	3	7,3	16,20	346,52	97,57	248,94	1	10,0	47,50
12	CM 9	2	140,11	60,98	79,13	3	7,8	16,47	360,98	105,24	255,74	1	11,0	50,02
12	CM 9	3	139,09	61,51	77,58	3	7,9	16,97	338,60	95,81	242,79	1	10,4	42,80
12	CM 9	4	136,51	60,20	76,31	3	7,5	15,87	304,56	89,67	214,89	1	10,5	40,50
12	CM 9	5	152,66	67,35	85,31	3	7,4	16,20	329,24	98,72	230,52	1	10,0	44,60
14b	CM 9	1	141,67	76,33	65,34	20	7,6	17,19	300,73	104,92	195,81	10	10,9	45,84
14b	CM 9	2	136,57	75,37	61,20	20	7,9	17,14	305,19	106,93	198,26	10	10,5	46,51
14b	CM 9	3	136,37	75,61	60,76	20	7,2	16,54	308,11	106,09	202,02	10	10,0	45,80
14b	CM 9	4	141,10	76,40	64,70	20	8,0	16,34	304,14	107,17	196,97	10	11,0	45,33
14b	CM 9	5	143,03	76,93	66,10	20	7,5	16,55	307,85	103,79	204,06	10	10,9	43,42
15	CM 9	1	110,86	56,91	53,95	3	7,6	16,21	284,08	92,42	191,66	2	10,5	46,27
15	CM 9	2	120,23	61,28	58,95	3	8,3	18,09	269,80	84,50	185,30	2	10,5	48,08
15	CM 9	3	124,64	64,08	60,56	3	7,7	17,55	267,89	82,91	184,98	2	10,3	43,29
15	CM 9	4	125,48	60,86	64,62	3	7,8	17,18	256,76	83,97	172,79	2	10,5	44,92
15	CM 9	5	114,09	61,05	53,04	3	7,4	15,84	294,78	88,38	206,40	2	10,7	46,24
16b	CM 9	1	141,67	76,33	65,34	20	8,1	16,05	300,73	104,92	195,81	10	10,9	45,69
16b	CM 9	2	137,57	77,37	60,20	20	7,9	16,90	309,76	101,58	208,17	10	11,0	47,90

Lab Code	Sample	Rep	ISO 3308						ISO 20778					
			Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg/cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg/cig)
16b	CM 9	3	137,89	76,32	61,57	20	7,5	16,89	312,91	100,79	212,12	10	10,2	47,87
16b	CM 9	4	138,79	67,25	71,54	20	7,9	17,01	308,63	101,81	206,82	10	11,0	48,37
16b	CM 9	5	133,23	69,12	64,11	20	7,9	16,87	312,86	98,60	214,26	10	10,4	44,57
3	KR 1R6F	1	95,08	32,38	62,70	4	7,5	10,30	453,03	85,13	367,90	2	9,0	43,56
3	KR 1R6F	2	128,08	45,44	82,64	4	7,9	10,20	295,11	61,09	234,03	2	8,1	44,86
3	KR 1R6F	3	120,38	43,69	76,68	4	7,8	10,50	465,65	76,60	389,05	2	8,5	47,06
3	KR 1R6F	4	86,86	37,92	48,94	4	7,7	9,50	413,24	107,53	305,70	2	8,5	43,36
3	KR 1R6F	5	100,43	43,47	56,96	4	7,6	10,70	374,41	98,48	275,93	2	8,1	40,00
12	KR 1R6F	1	98,17	37,34	60,84	3	7,0	8,50	443,18	121,71	321,47	1	8,8	53,10
12	KR 1R6F	2	85,19	33,77	51,43	3	7,3	9,13	410,78	113,49	297,28	1	8,8	42,00
12	KR 1R6F	3	98,90	40,08	58,82	3	6,9	8,90	442,08	125,76	316,32	1	8,9	46,40
12	KR 1R6F	4	107,38	44,54	62,84	3	7,0	9,43	431,54	117,56	313,98	1	9,0	47,40
12	KR 1R6F	5	95,23	37,13	58,10	3	7,4	9,23	408,94	119,37	289,57	1	8,1	43,60
14b	KR 1R6F	1	87,03	38,82	48,21	20	7,3	8,82	402,72	139,12	263,60	10	8,0	45,83
14b	KR 1R6F	2	87,24	39,89	47,35	20	7,6	8,90	386,83	135,93	250,90	10	9,0	46,74
14b	KR 1R6F	3	86,73	40,03	46,70	20	7,0	9,62	403,81	143,01	260,80	10	9,5	52,47
14b	KR 1R6F	4	89,46	40,45	49,01	20	7,7	10,01	403,83	141,23	262,60	10	8,9	50,08
14b	KR 1R6F	5	88,87	39,93	48,94	20	7,6	9,37	387,17	136,97	250,20	10	8,4	47,16
15	KR 1R6F	1	81,69	36,03	45,66	3	7,4	9,24	343,25	104,13	239,12	2	8,7	46,63
15	KR 1R6F	2	91,46	43,69	47,77	3	7,7	10,66	393,35	117,99	275,36	2	8,5	52,44
15	KR 1R6F	3	85,45	41,04	44,41	3	7,8	10,37	371,02	109,88	261,14	2	8,9	48,63
15	KR 1R6F	4	98,83	42,42	56,41	3	7,9	10,59	352,75	111,32	241,43	2	8,8	45,86
15	KR 1R6F	5	101,67	42,97	58,70	3	7,6	10,55	303,08	103,40	199,68	2	8,0	42,83

Lab Code	Sample	Rep	ISO 3308						ISO 20778					
			Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg/cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg/cig)
16b	KR 1R6F	1	97,00	43,58	53,42	20	7,4	9,79	407,44	141,32	266,12	10	8,3	44,57
16b	KR 1R6F	2	97,24	42,89	54,35	20	7,4	9,86	411,51	138,37	273,15	10	8,4	46,90
16b	KR 1R6F	3	96,54	46,42	50,12	20	7,4	9,80	406,04	130,29	275,74	10	8,1	45,88
16b	KR 1R6F	4	94,59	40,45	54,14	20	7,3	9,99	417,07	136,09	280,98	10	8,4	47,85
16b	KR 1R6F	5	88,87	39,93	48,94	20	7,5	10,02	412,27	138,81	273,45	10	8,4	43,66
3	KR 2R5F	1	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	KR 2R5F	2	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	KR 2R5F	3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	KR 2R5F	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	KR 2R5F	5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
12	KR 2R5F	1	19,67	5,60	14,07	3	7,5	2,40	385,14	97,24	287,89	1	7,1	33,30
12	KR 2R5F	2	18,21	5,73	12,48	3	8,0	2,47	353,08	88,10	264,98	1	7,0	28,20
12	KR 2R5F	3	14,36	4,33	10,03	3	7,6	2,63	302,98	92,52	210,46	1	8,0	18,70
12	KR 2R5F	4	18,67	5,37	13,30	3	7,7	2,43	425,68	123,73	301,94	1	6,9	33,10
12	KR 2R5F	5	19,42	6,19	13,23	3	7,7	2,23	419,19	110,98	308,21	1	7,0	31,40
14b	KR 2R5F	1	13,24	3,67	9,57	20	7,5	2,17	393,66	138,16	255,50	10	7,3	32,58
14b	KR 2R5F	2	14,00	3,91	10,09	20	7,6	2,62	392,05	135,25	256,80	10	7,9	33,35
14b	KR 2R5F	3	13,40	4,01	9,39	20	7,0	2,35	388,01	133,41	254,60	10	7,0	31,57
14b	KR 2R5F	4	13,85	3,98	9,87	20	8,0	2,21	390,79	133,69	257,10	10	7,6	33,08
14b	KR 2R5F	5	13,98	3,87	10,11	20	7,7	2,25	386,99	136,79	250,20	10	7,3	35,35
15	KR 2R5F	1	11,00	1,64	9,36	3	8,5	1,84	319,04	75,15	243,89	2	7,1	32,48
15	KR 2R5F	2	9,75	1,38	8,37	3	7,8	2,02	302,19	87,00	215,19	2	7,3	28,79
15	KR 2R5F	3	10,87	1,85	9,02	3	7,8	2,25	302,70	80,07	222,63	2	7,2	28,88

Lab Code	Sample	Rep	ISO 3308						ISO 20778					
			Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg/cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg/cig)
15	KR 2R5F	4	10,76	1,55	9,21	3	8,2	1,99	320,20	85,37	234,83	2	7,0	34,88
15	KR 2R5F	5	9,58	1,16	8,42	3	7,9	1,94	264,68	71,30	193,38	2	6,9	25,01
16b	KR 2R5F	1	12,61	3,13	9,48	20	7,9	2,14	384,68	134,23	250,45	10	7,7	27,69
16b	KR 2R5F	2	13,22	3,21	10,01	20	7,7	2,20	381,13	120,49	260,64	10	7,4	30,26
16b	KR 2R5F	3	13,26	3,28	9,98	20	7,5	2,23	381,07	120,74	260,33	10	7,4	29,46
16b	KR 2R5F	4	12,94	3,12	9,82	20	7,7	2,41	380,96	121,01	259,96	10	7,5	31,57
16b	KR 2R5F	5	13,51	4,54	8,97	20	7,8	2,31	380,66	120,95	259,71	10	7,8	27,25
3	Sample 1	1	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 1	2	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 1	3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 1	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 1	5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
12	Sample 1	1	30,97	10,00	20,97	3	6,0	3,00	359,52	86,79	272,73	1	6,8	33,20
12	Sample 1	2	37,65	12,49	25,16	3	6,0	3,47	389,38	81,94	307,44	1	8,6	29,10
12	Sample 1	3	32,39	10,96	21,43	3	6,0	3,67	300,79	71,14	229,66	1	7,2	24,90
12	Sample 1	4	33,95	11,49	22,46	3	6,3	3,00	312,55	71,44	241,10	1	7,3	23,00
12	Sample 1	5	31,14	10,82	20,32	3	6,0	3,37	314,13	79,01	235,12	1	7,1	22,70
14b	Sample 1	1	26,97	8,78	18,19	20	6,3	3,40	318,65	95,92	222,73	10	7,1	34,34
14b	Sample 1	2	26,64	8,33	18,31	20	6,4	3,30	335,90	101,51	234,39	10	7,3	34,35
14b	Sample 1	3	26,31	8,03	18,28	20	6,1	3,24	332,50	95,47	237,03	10	7,0	34,93
14b	Sample 1	4	26,69	8,61	18,08	20	6,3	3,12	338,12	101,01	237,11	10	7,5	34,66
14b	Sample 1	5	26,71	8,32	18,39	20	6,4	3,30	325,71	96,82	228,89	10	7,0	34,93
15	Sample 1	1	26,44	7,70	18,74	3	6,0	3,21	264,79	68,15	196,64	2	6,9	29,15

Lab Code	Sample	Rep	ISO 3308						ISO 20778					
			Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg /cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg /cig)
15	Sample 1	2	28,43	7,98	20,45	3	6,8	3,45	284,34	75,87	208,47	2	6,7	29,50
15	Sample 1	3	24,77	6,88	17,89	3	6,3	3,26	255,29	65,87	189,42	2	7,2	28,87
15	Sample 1	4	27,50	7,00	20,50	3	6,7	3,36	281,48	73,47	208,01	2	7,2	29,79
15	Sample 1	5	30,42	8,43	21,99	3	6,7	3,39	249,33	64,74	184,59	2	7,3	28,17
16b	Sample 1	1	29,97	10,78	19,19	20	6,2	3,13	330,66	105,42	225,24	10	7,4	26,90
16b	Sample 1	2	28,64	9,33	19,31	20	6,0	3,23	336,54	90,43	246,11	10	7,2	28,66
16b	Sample 1	3	28,48	9,57	18,91	20	6,1	3,13	331,58	90,70	240,88	10	7,1	27,57
16b	Sample 1	4	27,69	10,61	17,08	20	6,1	3,12	344,93	95,96	248,97	10	7,0	29,86
16b	Sample 1	5	30,43	10,12	20,31	20	6,2	3,35	332,31	91,98	240,33	10	7,3	25,69
3	Sample 2	1	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 2	2	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 2	3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 2	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 2	5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
12	Sample 2	1	69,67	25,01	44,66	3	6,0	5,37	319,02	90,03	228,99	1	6,4	29,80
12	Sample 2	2	63,73	23,83	39,90	3	5,9	5,57	399,96 ⁶ ₁	102,84	297,12	1	6,6	37,50
12	Sample 2	3	74,75	27,32	47,43	3	5,9	6,07	312,82	71,88	240,95	1	7,0	24,80
12	Sample 2	4	67,78	24,90	42,88	3	6,0	5,03	317,93	78,60	239,34	1	7,2	23,80
12	Sample 2	5	73,41	26,87	46,55	3	6,0	5,80	327,32	92,34	234,98	1	6,4	28,20
14b	Sample 2	1	58,13	22,32	35,81	20	5,9	5,03	341,58	99,46	242,12	10	7,4	38,24
14b	Sample 2	2	57,88	21,94	35,94	20	6,0	5,11	349,10	100,80	248,30	10	7,7	36,26
14b	Sample 2	3	60,06	22,83	37,23	20	5,9	5,84	348,49	99,59	248,90	10	7,9	39,11
14b	Sample 2	4	58,50	21,91	36,59	20	6,0	5,28	347,46	102,86	244,60	10	7,1	37,96

Lab Code	Sample	Rep	ISO 3308						ISO 20778					
			Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg/cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg/cig)
14b	Sample 2	5	60,37	22,66	37,71	20	5,9	5,67	354,81	102,91	251,90	10	8,0	36,06
15	Sample 2	1	56,32	19,20	37,12	3	6,3	5,37	318,86	77,82	241,04	2	7,9	34,53
15	Sample 2	2	57,00	18,36	38,64	3	6,2	5,20	322,98	82,35	240,63	2	7,3	34,76
15	Sample 2	3	55,83	17,69	38,14	3	6,1	4,69	323,26	79,55	243,71	2	6,9	30,40
15	Sample 2	4	55,24	18,45	36,79	3	6,0	5,05	274,68	71,25	203,43	2	7,7	29,03
15	Sample 2	5	59,51	19,98	39,53	3	6,2	5,11	318,92	78,05	240,87	2	7,4	32,33
16b	Sample 2	1	53,16	20,12	33,04	20	6,1	5,20	342,24	100,12	242,12	10	7,4	30,26
16b	Sample 2	2	52,43	18,54	33,89	20	6,0	5,42	356,48	95,76	260,72	10	7,0	32,55
16b	Sample 2	3	54,79	20,32	34,47	20	6,0	5,54	365,96	98,61	267,35	10	7,1	31,26
16b	Sample 2	4	55,68	23,45	32,23	20	6,1	5,68	354,55	97,72	256,83	10	7,5	33,56
16b	Sample 2	5	52,18	19,47	32,71	20	5,9	5,46	362,26	97,76	264,50	10	7,2	29,56
3	Sample 3	1	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 3	2	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 3	3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 3	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 3	5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
12	Sample 3	1	65,09	29,99	35,10	3	6,2	6,83	318,58	80,78	237,81	1	8,0	41,90
12	Sample 3	2	91,90	38,62	53,28	3	5,8	8,93	300,87	85,28	215,58	1	7,6	38,00
12	Sample 3	3	90,00	37,32	52,68	3	6,0	9,40	325,93	87,62	238,31	1	7,8	38,20
12	Sample 3	4	86,22	36,94	49,28	3	6,3	8,70	240,40	59,35	181,05	1	8,0	27,70
12	Sample 3	5	97,83	39,07	58,75	3	6,3	9,30	294,09	78,00	216,09	1	7,8	32,50
14b	Sample 3	1	84,45	38,33	46,12	20	6,0	8,99	231,60	69,35	162,25	10	8,0	29,64
14b	Sample 3	2	85,83	37,81	48,02	20	6,1	8,71	248,11	71,06	177,05	10	8,9	29,07

Lab Code	Sample	Rep	ISO 3308						ISO 20778					
			Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg /cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg /cig)
14b	Sample 3	3	86,52	39,31	47,21	20	5,8	9,13	236,30	69,02	167,28	10	7,5	29,68
14b	Sample 3	4	86,74	39,82	46,92	20	6,0	9,08	241,27	70,15	171,12	10	8,8	30,65
14b	Sample 3	5	86,35	38,32	48,03	20	6,1	8,98	243,66	70,53	173,13	10	8,9	31,03
15	Sample 3	1	76,92	32,24	44,68	3	6,0	8,50	233,78	64,79	168,99	2	7,7	32,33
15	Sample 3	2	75,17	34,30	40,87	3	6,3	8,98	247,88	65,72	182,16	2	8,0	36,05
15	Sample 3	3	73,73	30,65	43,08	3	5,7	7,54	230,99	64,58	166,41	2	7,8	33,24
15	Sample 3	4	68,72	30,67	38,05	3	6,0	8,35	219,54	62,91	156,63	2	8,5	33,05
15	Sample 3	5	72,57	32,47	40,10	3	6,0	9,07	220,66	60,05	160,61	2	7,6	31,67
16b	Sample 3	1	80,45	33,35	47,10	20	6,0	8,12	267,78	85,53	182,25	10	8,3	33,66
16b	Sample 3	2	84,18	35,64	48,54	20	5,9	8,25	273,41	77,01	196,40	10	8,0	35,69
16b	Sample 3	3	82,35	36,57	45,78	20	5,9	8,48	271,83	84,57	187,26	10	8,4	34,57
16b	Sample 3	4	79,86	32,87	46,99	20	6,1	8,88	264,78	76,14	188,63	10	8,5	36,54
16b	Sample 3	5	81,76	36,45	45,31	20	6,1	8,76	274,98	80,39	194,59	10	8,1	32,55
3	Sample 4	1	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 4	2	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 4	3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 4	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
3	Sample 4	5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
12	Sample 4	1	105,96	42,93	63,03	3	6,3	12,03	248,22	63,85	184,37	1	9,0	38,90
12	Sample 4	2	99,68	43,46	56,22	3	6,0	12,37	254,83	70,11	184,72	1	8,0	34,50
12	Sample 4	3	92,56	41,48	51,08	3	6,0	11,10	255,97	74,87	181,10	1	8,7	39,90
12	Sample 4	4	100,68	43,01	57,67	3	6,0	11,73	238,59	69,53	169,06	1	8,9	34,60
12	Sample 4	5	98,75	45,01	53,73	3	6,3	13,17	252,97	73,46	179,50	1	8,9	37,00

Lab Code	Sample	Rep	ISO 3308						ISO 20778					
			Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg /cig)	Total HCN (µg/cig)	Pad HCN (µg/cig)	Imp HCN (µg/cig)	Cigs/rep	Puff Ct (/cig)	TPM (mg /cig)
14b	Sample 4	1	102,29	54,04	48,25	20	6,5	12,65	244,36	76,25	168,11	10	9,0	42,48
14b	Sample 4	2	101,70	52,97	48,73	20	6,4	12,87	245,57	78,25	167,32	10	8,4	41,56
14b	Sample 4	3	103,17	53,01	50,16	20	6,1	12,36	241,16	77,15	164,01	10	8,8	41,58
14b	Sample 4	4	101,65	53,45	48,20	20	6,2	13,00	239,27	74,49	164,78	10	9,1	40,05
14b	Sample 4	5	103,19	53,02	50,17	20	6,3	13,26	244,04	76,81	167,23	10	8,1	41,20
15	Sample 4	1	70,38	33,80	36,58	3	6,4	11,33	181,76	54,00	127,76	2	8,0	34,69
15	Sample 4	2	73,11	35,99	37,12	3	6,2	11,39	195,86	58,56	137,30	2	8,7	34,64
15	Sample 4	3	89,60	42,83	46,77	3	6,0	13,30	196,97	60,15	136,82	2	8,7	38,01
15	Sample 4	4	82,78	40,08	42,70	3	6,5	12,31	208,53	61,35	147,18	2	8,6	37,51
15	Sample 4	5	76,17	37,55	38,62	3	6,0	11,43	195,52	60,65	134,87	2	9,2	38,82
16b	Sample 4	1	102,24	47,04	55,20	20	6,0	12,57	248,36	70,25	178,11	10	8,9	35,90
16b	Sample 4	2	105,70	48,97	56,73	20	6,1	12,24	250,02	74,34	175,69	10	9,0	37,66
16b	Sample 4	3	101,68	50,23	51,45	20	6,2	12,42	245,50	73,29	172,21	10	8,5	36,55
16b	Sample 4	4	101,25	52,01	49,24	20	6,0	12,87	243,78	70,77	173,02	10	8,5	38,56
16b	Sample 4	5	100,11	45,24	54,87	20	6,0	13,01	248,56	72,97	175,59	10	8,5	34,55

Where NR = not reported, *G1 Values detected as outliers by single Grubbs' test

Appendix G - IUPAC 1994 Harmonized Statistical Procedure

IUPAC 1994 HARMONIZED STATISTICAL PROCEDURE

