Smoke Analysis Sub-Group

Technical Report

2021 Study for NOx in Mainstream Cigarette Smoke

June 2022

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1. Summary

In 2021, the CORESTA Smoke Analysis Sub-Group (SA SG) launched project 295 with the objective to establish a CRM for analysis for oxides of nitrogen (NOx) in mainstream cigarette smoke.

The study reported here was conducted using 2R5F and 1R6F reference cigarettes and CM9 monitor cigarette smoked under ISO intense (ISO 20778) and non-intense (ISO 3308) regimes. The study design afforded an evaluation across 10-fold range of the analytes of interest.

Twelve laboratories participated in the study. One laboratory provided two data sets. Based on the reported results, it was noted that all of the laboratories used the same methodology, automated chemiluminescence with either in-line (11 data sets) or off-line (2 data sets) analysis.

Outlier determination (one dataset), z-scores, repeatability (r) values, and reproducibility (R) values were determined and are presented. Based on the robustness of the methodology and results of this study, a CRM for the determination of NOx by chemiluminescence will be developed.

2. Introduction

The overall objective of Project 295 is to develop a CORESTA Recommended Method (CRM) for the determination of oxides of nitrogen (NOx[1]) in cigarette mainstream smoke. The initial approach was to conduct a series of studies to establish one candidate method for CRM development.

The original purpose of this study was to conduct a study in which participants follow the testing protocol using their own analytical methodology to allow for a narrowing of method candidates for a follow-up joint experiment or collaborative study (CS). But as described, it was determined that the participating laboratories use the same method with some differences in details that will be discussed.

The study design included reference and monitor samples across a range of nominal ISO 3308 tar levels and use of an intense and non-intense regime in order to evaluate methodology across a broad analyte and matrix level. Laboratories reported method details, basic smoking measures and NOx, and optionally, NO yields.

Statistical evaluations were made in general conformance with ISO 5725-2 recommendations. Included in this report are descriptive statistics, raw data, z-scores, and repeatability and reproducibility estimates.

3. Organisation

3.1 Participants

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

[1] NOx may generally refer to a grouping of different nitrogen oxides or specifically to the sum of NO and NO_2. NOx detectors report NOx and may also report NO and/or NO_2.

Table 1. Participating Laboratories

Testing Participants
China National Tobacco Corp., Beijing Cigarette Factory
Borgwaldt KC GmbH
Enthalpy Analytical
Japan Tobacco Inc.
JT International, Ökolab
KT&G Research Institute
Labstat International Inc
Philip Morris International Brazil
Philip Morris International Indonesia
Philip Morris International Switzerland
Reemtsma Cigarettenfabriken GmbH – Imperial Brands
Souza Cruz SA, BAT

3.2 Study Test Articles

The study test articles are noted in Table 2 below. The University of Kentucky reference products and monitor cigarette CM9 were used for the study as they represent a range of design features typical of the product category.

Table 2. Study Test Articles

Sample ID		Description
Sample A		Kentucky Reference 2R5F
Sample B		Kentucky Reference 1R6F
Sample C		CM9

3.3 Protocol

The Study Protocol is described briefly below and in full in Appendix A. Participating laboratories were asked to obtain their own supply of Kentucky Reference and CORESTA Monitor Test Pieces.

Participating laboratories were asked to smoke using ISO intense (ISO 20778) and non-intense (ISO 3308) regimes and report five replicates for each test article and each smoking regime. A replicate was defined as a single measurement rather than a certain number of cigarettes. Laboratories were asked to establish a composite sample prior to smoking if there was an expectation of a time delay between smoking under each regime. No other run order requirements were provided. Note that Lab 10 submitted two data sets. One set was from an in-line[2] analysis method and designated as 10IL in this report. The other set was from an off-line analysis method and designated as 10OL.

Reportable measures included puff count, total particulate matter (TPM), oxides of nitrogen (NOx), and, optionally, nitric oxide (NO).

[2] Where in-line indicates that the smoke stream is directed through the detector in real-time. Off-line indicates that the smoke from all of the cigarettes is collected, for example in a gas bag, and then passed through the analyzer.

4. Data – Statistical Analysis

Data analysis was performed following the statistical model provided by ISO 5725-2 (1994) ("basic method for the determination of repeatability and reproducibility of a standard measurement method"). All laboratory data were used in statistical evaluation expect for removal of outlying data as noted. Minor adjustments were made to the recommendations of ISO 5725-2 because not all labs smoked the same number of cigarettes per port. As described below, this led to deviations to the model assumed in the ISO standard and to account for that only Grubbs Test was used for outlier detection and a weighted analysis of variance was used for the calculation of repeatability and reproducibility.

Raw data are presented in summarized data in B and C and graphs of the data are shown in Appendix D reported as µg/tp (test piece). More raw data are in Appendix F and Appendix G. Data are reported to two or more decimal places without regard for significant figures. Non-reported values are noted as "NR" with a reason code if available.

4.1 Outlier Detection

As noted above, only Grubbs Test for mean value outliers was employed. Since different labs used different numbers of cigarettes per replicate, it was expected that there would be lab-to-lab differences in the intra-lab standard deviations, so outliers of that type were not evaluated. Lab 10OL was identified as an outlier or near outlier in most of the testing and was not included in the repeatability and reproducibility analysis. No other labs were identified as outliers.

4.2 Z-Scores

The study was conducted in accordance with ISO/IEC 17043 and the calculations were done in general conformance with ISO 13528.

Z-scores are given in standard deviation units from the assigned value ("average"), and the assigned values and standard deviations for proficiency assessment were estimated using Algorithm A given in ISO 13528. 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, and laboratories having values with $3 \leq |z|$ should be treated as an "action signal" to investigate laboratory performance. Graphs of the z-scores for NO and NOx are given in Figures 1 and 2, respectively. Individual z-scores are shown in Table 3.

Table 3. Z-Scores NO and NOx

	Non-Intense			Intense		
	Sample A	**Sample B**	**Sample C**	**Sample A**	**Sample B**	**Sample C**
NO						
Mean	63,1	150,7	62,8	319,1	363,8	125,3
Stdev	8,1	11,0	7,2	30,8	36,5	23,7
Lab	**z-scores NO**					
1	0,97	-0,33	-0,29	-0,36	-0,33	-0,36
2	-1,05	-0,39	-1,01	-0,44	-0,39	-0,56
3	0,21	0,67	0,45	0,74	0,67	0,39
4	0,29	1,23	0,10	1,41	1,23	NA
5	0,45	-0,19	0,10	-0,60	-0,19	0,01

	Non-Intense			Intense		
	Sample A	**Sample B**	**Sample C**	**Sample A**	**Sample B**	**Sample C**
6	-0,98	-0,06	-0,37	-0,23	-0,06	0,09
7	-0,12	-0,48	-0,19	-0,44	-0,48	-0,25
9	0,58	1,63	1,28	1,13	1,63	1,26
10IL	0,06	1,00	0,81	1,09	1,00	0,55
10OL	-3,11	-4,02	-6,28	-4,46	-4,02	-1,98
11	0,93	0,08	0,14	0,40	0,08	0,08
13	1,21	-0,48	2,00	-0,98	-0,48	2,55
15	-1,04	-1,05	-1,02	-0,23	-1,05	-1,22

	Non-Intense			Intense		
	Sample A	**Sample B**	**Sample C**	**Sample A**	**Sample B**	**Sample C**
NOx						
Mean	69,1	173,7	75,6	380,0	430,6	148,7
Stdev	11,8	16,6	8,5	38,7	41,7	30,5
Lab	**z-scores NOx**					
1	0,77	0,86	0,15	0,09	0,15	-0,24
2	-1,15	-1,27	-0,80	-0,57	-0,61	-0,91
3	-0,26	0,29	-0,58	0,52	0,44	-0,17
4	-0,06	-0,86	-0,51	0,80	0,73	NA
5	0,30	0,46	0,17	-0,28	0,04	-0,03
6	-0,92	0,45	-0,38	0,23	0,39	0,11
7	-0,16	0,28	-0,10	0,20	0,15	-0,17
9	1,47	0,03	1,73	0,22	0,68	1,42
10IL	-0,14	0,87	0,23	1,27	1,20	0,06
10OL	-2,20	-6,01	-6,27	-2,92	-3,14	-1,89
11	0,89	1,11	1,21	1,17	0,85	0,70
13	1,04	0,40	1,22	-1,51	-1,10	1,90
15	-0,28	-1,12	-0,63	-0,64	-1,41	-0,78

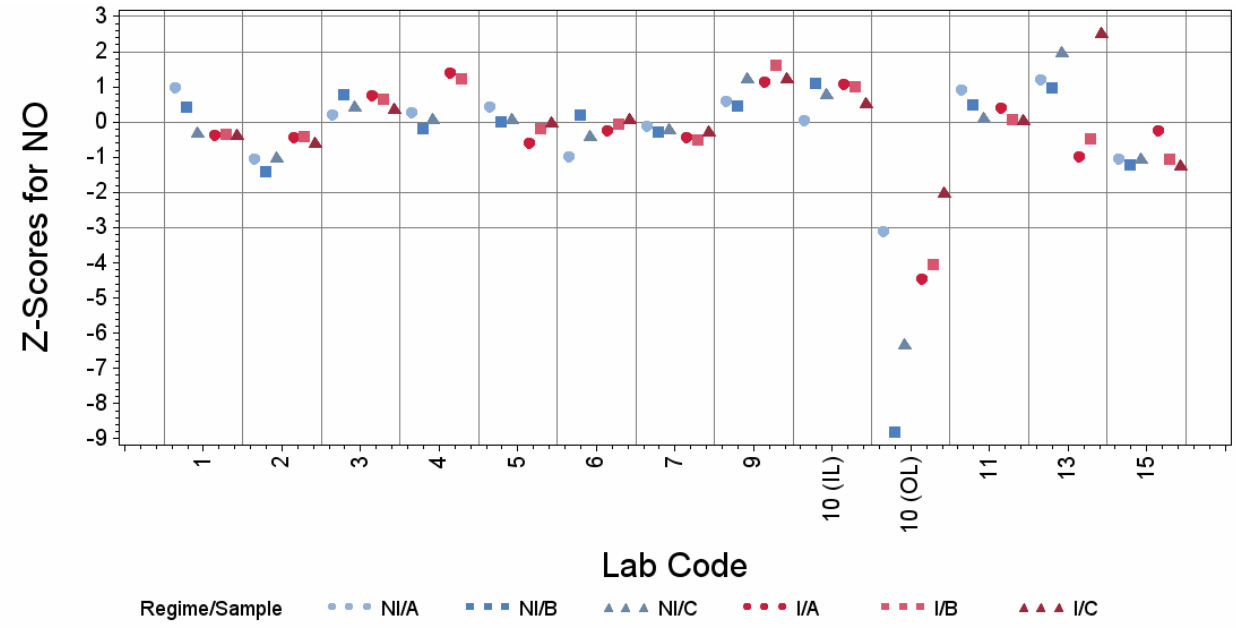


Figure 1. Z-Scores for the analyte NO for the three cigarettes A, B, and C under the Intense and Non-Intense smoking regimes

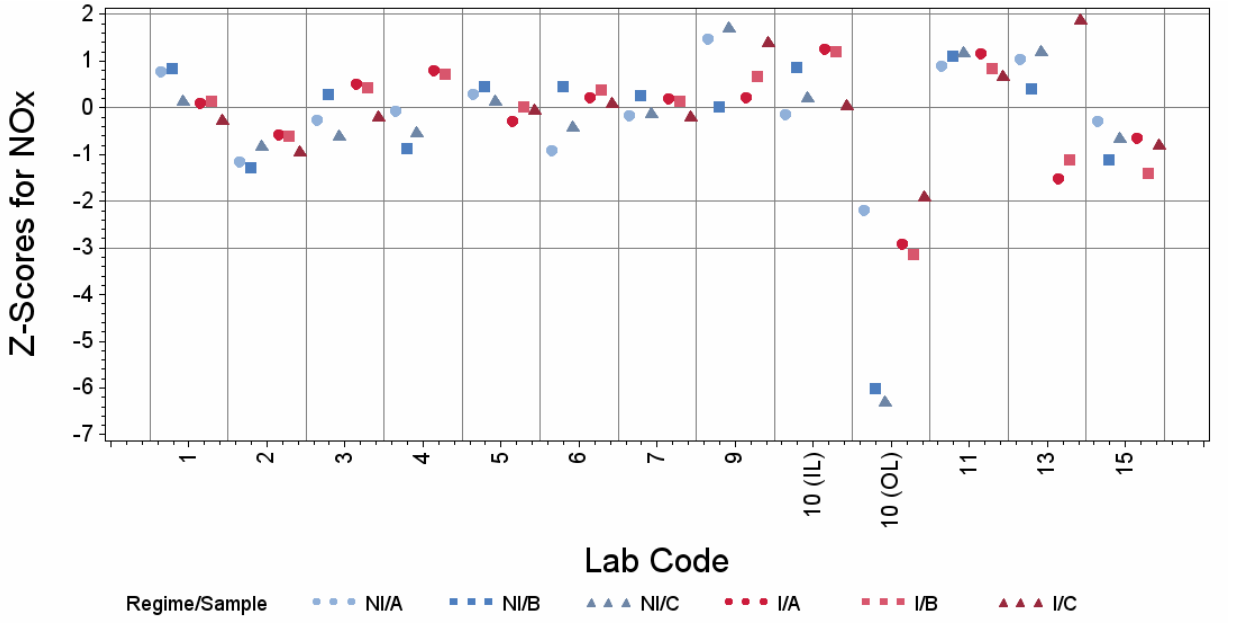


Figure 2. Z-Scores for the analyte NOx for the three cigarettes A, B, and C under the Intense and Non-Intense smoking regimes.

The z-scores reinforce the finding that lab 10OL was an outlier. There is a sprinkling of additional points with 2<|z|<3, but generally the other points were consistent.

4.3 Repeatability and Reproducibility

Repeatability and reproducibility (r & R) limits were calculated for both smoking regimes and each of the three tested products. In this study, there was not a pre-specified number of cigarettes to smoke per port per regime for each of the labs and different labs chose different numbers of cigarettes. The number of cigarettes smoked would be expected to affect the intra-lab variability. To a first approximation, it would be expected that the variability will be such that $\boldsymbol{\sigma} \propto \frac{\mathbf{1}}{\sqrt{\boldsymbol{n}}}$. That is, the more cigarettes to a replicate the smaller within lab variation would be expected to be. Empirically the relationship is not tight, since standard deviation is difficult to estimate accurately and other factors are likely to affect the standard deviation, but we do see a negative correlation between the number of cigarettes smoked and the intra-lab standard deviation. To account for that, as noted above, a weighted analysis was used to account for the different number of cigarettes smoked.[3]

The estimated r & R limits are given in Table 4.

Table 4. Estimated r & R Limits. Weighted to represent 20 cigarettes for non-intense smoking and 10 cigarettes for intense smoking for one replicate.

Sample	Mean	N Data Sets*	r	r (%)	R	R (%)
NO Non-Intense (µg/cig)						
A	64	13		8.2 %	17.4	27.2 %
B	153	13	9.7	6.3 %	23.0	15.1 %
C	64	13	3.8	5.9 %	16.6	25.9 %
NO Intense (µg/cig)						
A	323	13	28.3	8.8 %	66.9	20.7 %
B	369	13	26.4	7.1 %	80.9	21.9 %
C	131	12	9.7	7.4 %	65.0	49.7 %
NOx Non-Intense (µg/cig)						
A	71	13	6.0	8.6 %	26.3	37.3 %
B	177	13	11.8	6.7 %	34.8	19.7 %
C	77	13	4.9	6.3 %	19.4	25.3 %
NOx Intense (µg/cig)						
A	386	13	34.0	8.8 %	83.4	21.6 %
B	437	13	30.4	7.0 %	88.5	20.2 %
C	154	12	12.1	7.9 %	72.1	46.9 %

* Where outlying data have been removed

[3] The calculations were weighted to estimate the variability *as if* 20 cigarettes were smoked per replicate under non-intense conditions and 10 cigarettes per replicate under intense conditions.

5. Discussion

5.1 Methodology

Laboratories were instructed to use their own method for the study so that we would be able to compare results and choose candidate methods for follow up CS. A review of the labs' methods shows high consistency for method parameters. For example, all laboratories use chemiluminescence and linear calibration. Differences among the laboratory methods included type of smoking machine, number of cigarettes smoked, and number calibration standards. Most laboratories used an in-line method. See Figure 3 below for a generalized method summary and Appendix E for a comparison of details among the reporting laboratories.

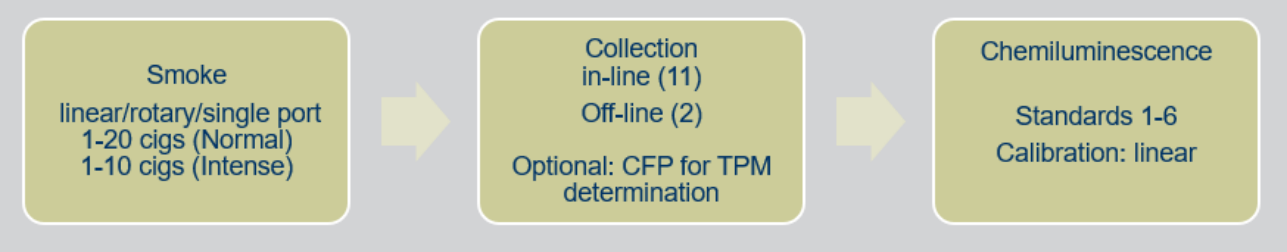


Figure 3: An overall method summary for Mainstream NOx determination

5.2 Smoking & Analytes

Linear, rotary, and single-port smoking machines from different manufacturers were employed. Labs smoked 1, 5, 10, or 20 cigarettes for non-intense regime and 1, 2, 3, 5, or 10 cigarettes for intense regime. NO and NOx data were acquired with in-line analysis for eleven of the thirteen data sets, analyte data was collected for nine of them without a gas phase trap, while one lab employed a flat-bottomed flask (1 L) and another used round bottomed 3 neck boiling flasks (5-6 L). Two labs conducted off-line analysis, both using a gas collection bag (10 L) as the gas phase trap. Interestingly, smoke constituents (conditioned weight, puff count, and TPM) reported in data set (10OL) were consistent with smoke data reported in the other data sets, even though the analyte data (NO and NOx) were not. This observation suggests that smoke collection was adequate, and that there may be some issues or errors associated with the analysis.

The sample set and regimes chosen provide a wide range of TPM and analyte yield for method evaluation. A comparison of intense smoking to non-intense smoking data revealed an increase in TPM; 11-fold for sample A, 4-fold for sample B, and 2-fold for sample C. An increase was also observed in the NO and NOx amounts collected from intense smoking compared to non-intense smoking, 5-fold for sample A, and 2-fold for samples B and C. There was no significant change observed for conditioned cigarette weight and puff count. Additionally, the amount of NO and NOx in samples A and C are similar for the non-intense regime, but the intense regime data shows 2.5 times more NO and NOx in Sample A compared to Sample C. A similar comparison between samples B and C showed that NO and NOx levels in Sample B were about 2.5 times higher than the levels in Sample C for both intense and non-intense regimes. Sample A has the most air dilution, consistent with the highest increase in TPM, NO, and NOx from the intense to non-intense data comparison, followed by sample B and then sample C.

Even though labs smoked different numbers of cigarettes using different types of smoking machines from different manufacturers (Appendix E), the mean smoke data for each sample and each regime were consistent across all data sets. Analyte data were consistent for each test sample and each smoking regime among all data sets, except 10OL. NO and NOx data from the two labs that employed flasks with in-line analysis were consistent with the other labs. Lab

9 collected analyte data using offline analysis and the data reported were consistent with the labs that collected analyte data employing in-line analysis. All z-scores were within acceptable limits except for the one outlying data set. Recall the calculated r &R limits for NO and NOx from combined data sets presented in Table 4, repeatability values were less than 10 % and reproducibility values below 50 % with an average of 28 % for NOx.

6. Conclusions

Through this study, CORESTA was able to establish that participating laboratories' methodologies were the same except for details, such as number of cigarettes smoked, that did not appear to cause differences in results (i.e. only one laboratory had outlying data). Therefore, the SG is recommending to establish a method for the determination of NOx in cigarette smoke by chemiluminescence based on the results of this study. The scope of the study included 13 data sets laboratories testing 3 cigarette samples across a range of typical blend platforms and a range of TPM values of approximately 2 mg – 50 mg (ISO 3308, ISO 20778) and using three types of smoking machine designs and two smoking regimes. The NOx tested across this sample set covered a 10-fold range of the analytes of interest. The methodology appears robust enough to allow for tar levels, varied collection parameters, and a range of manufacturers for analytical equipment. Repeatability values calculated from combined data were less than 10 %. Reproducibility estimates ranged from 15-50 % with higher R% noted for CM9 Intense results. Next steps for Project 295 include development of a CORESTA Recommended Method to include the method and r&R values from this study.

Appendix A: Study Protocol

CORESTA Smoke Analysis Sub-Group

Project Title:	Project 295 NOx Study 1 - Proficiency Testing Study
Type of Document:	Protocol
Date:	February 15, 2021
Written by:	Rana Tayyarah

1. Objective

The objective of this study is to conduct a proficiency study to aid selection of candidate testing methods for development of a CRM for optional in-line and flow-through analysis for oxides of nitrogen (NOx) in mainstream cigarette smoke.

2. Time Schedule

Date	Activity
February 2021	Launch - Study Coordinator to distribute protocol and template
May 7, 2021	Testing - Laboratories to secure own supply of cigarettes and submit results prior to this date
June 7, 2021	Data Analysis and Accuracy review
July 9, 2021	Workstream review and next steps decisions
Aug 20, 2021	Final report submitted to Scientific Commission

3. Methods

3.1 Test Products

Sample	Description	Lot/Batch	Number of Cigarettes to procure
Sample A	Kentucky Reference 2R5F	Not specified	1 carton
Sample B	Kentucky Reference 1R6F	Small Batch (see website)	1 carton
Sample C	CM9	Not specified	1 carton

Samples will be procured directly by the testing labs from **commercial suppliers**. **Laboratories may use their own supply if lot/batch matched and if stored in accordance with vendor specifications.**

Each laboratory shall dispose of retained samples in accordance with their own internal practices for sample disposal.

3.2 Study Control

NA

3.4 Sampling

A composite of all packs 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.

3.5 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.**

3.6 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 from a **laboratory's own supplies, they should be stored according to internal practices if compliant with vendor specifications.**

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.**

3.7 Filter Ventilation Zone Blocking (Intense Smoking)

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

3.8 Replicates and Run Order

For **purposes of this study, a replicate is a single measurement ('pad') regardless of the number of cigarettes needed for the test.**

The analysis of five (5) replicates per sample shall be reported.

Sample run order shall be organized by replicate number rather than sample number. In other words**, all first replicates for all samples shall be collected and analysed together, all second replicates for all samples shall be collected and analysed together, etc.**

If the capacity of the collection apparatus is sufficient for testing more than one replicate set**, more than one replicate may be tested together. For example, for a 20-port linear machine all replicates may be smoked at the same time.**

If fewer collection ports than the number of samples are available, replicates shall be collected **sequentially.**

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

3.9 Smoking Parameters

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

3.10 Extraction and Analysis

Each laboratory shall follow its own procedures for extraction and analysis. Method details shall be reported using the template provided.

3.11 Analytes and Measures

Report results for puff count (/cig), total particulate matter (TPM) (mg/cig), conditioned weight[4] (mg/cig), and the analytes listed below using the data template provided. If your method does not provide NO data, please make a note in the reporting template.

Analyte	Reporting units
NO	**µ**g/cig
NOx	**µ**g/cig

3.12 Repeat Analysis

Five (5) replicates are requested. Replicate is defined for purposes of this study as 'individual measure' i.e. 'pad' rather than being defined based on number of cigarettes smoked for a set. If a defective product is encountered, that product shall be removed from the test pool. Number of failed replicates (repeat analysis events) is requested for reporting in the data template.

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.

There is a tab for inclusion of your data from the recent UofK PT as an optional input if that work was conducted using the same method. Note that only CM9 is in common between the two studies. This information will provide additional data analysis options.

Results shall be reported back to Rana Tayyarah and Jana Jeffery on or before May 7, 2021.

4.1 Data Analysis

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

5. Reference Documents

Data reporting Template	Excel spreadsheet provided (file attached to protocol)

[4] For cigarettes without vent-blocking tape applied

Appendix B: Summarized Data –Non-Intense

2R5F

		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
1	avg	827.66	8.19	2.54	71.03	78.19
	stdev	5.07	0.06	0.18	3.13	3.66
	%RSD	0.6	0.8	7.2	4.4	4.7
2	avg	829.20	7.68	2.18	54.60	55.60
	stdev	5.31	0.36	0.13	1.82	2.97
	%RSD	0.6	4.7	6.0	3.3	5.3
3	avg	828.60	7.16	2.24	64.82	66.00
	stdev	3.21	0.12	0.07	3.11	3.63
	%RSD	0.4	1.6	3.0	4.8	5.5
4	avg	NR	7.20	NR	65.48	68.38
	stdev	NR	0.45	NR	4.86	5.04
	%RSD	NR	6.2	NR	7.4	7.4
5	avg	834.03	7.92	2.59	66.79	72.69
	stdev	6.77	0.07	0.05	3.52	3.84
	%RSD	0.8	0.9	2.0	5.3	5.3
6	avg	828.12	7.40	2.22	55.14	58.22
	stdev	4.07	0.13	0.18	2.56	2.93
	%RSD	0.5	1.7	8.2	4.6	5.0
7	avg	827.54	7.82	2.40	62.18	67.21
	stdev	12.09	0.24	0.10	2.32	2.67
	%RSD	1.5	3.1	4.1	3.7	4.0
9	avg	828.39	8.42	2.78	67.86	86.49
	stdev	13.47	0.35	0.07	2.41	2.38
	%RSD	1.6	4.2	2.3	3.6	2.8
10IL	avg	827.38	7.79	2.38	63.60	67.50
	stdev	2.18	0.06	0.09	1.95	2.16
	%RSD	0.3	0.8	3.9	3.1	3.2

Where NR = not reported
*outlying data not included in r&R calculations

2R5F

		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
10OL	avg	827.38	7.79	2.38	37.80*	43.19*
	stdev	2.18	0.06	0.09	2.66	3.95
	%RSD	0.3	0.8	3.9	7.0	9.2
11	avg	839.17	8.06	2.66	70.66	79.64
	stdev	2.12	0.09	0.18	1.58	2.14
	%RSD	0.3	1.1	6.8	2.2	2.7
13	avg	810.48	8.10	2.41	72.93	81.32
	stdev	7.25	0.07	0.12	1.69	1.62
	%RSD	0.9	0.9	4.9	2.3	2.0
15	avg	828.50	8.00	NR	54.64	65.74
	stdev	33.68	0.00	NR	8.93	9.63
	%RSD	4.1	0.0	NR	16.3	14.7

Where NR = not reported
*outlying data not included in r&R calculations

1R6F

		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
1	avg	889.36	7.75	10.29	155.57	187.93
	stdev	5.38	0.12	0.36	2.78	3.02
	%RSD	0.6	1.6	3.5	1.8	1.6
2	avg	893.40	7.22	10.00	135.20	152.60
	stdev	5.59	0.08	0.29	8.44	12.88
	%RSD	0.6	1.2	2.9	6.2	8.4
3	avg	891.20	6.78	9.76	159.45	178.50
	stdev	4.44	0.06	0.14	3.33	4.55
	%RSD	0.5	0.9	1.4	2.1	2.6
4	avg	NR	7.00	NR	148.90	159.40
	stdev	NR	0.00	NR	12.54	13.02
	%RSD	NR	0.0	NR	8.4	8.2
5	avg	893.56	7.42	9.86	150.87	181.28
	stdev	4.80	0.07	0.10	2.89	3.23
	%RSD	0.5	1.0	1.0	1.9	1.8
6	avg	904.08	7.21	10.32	152.91	181.21
	stdev	6.79	0.17	0.12	6.01	7.32
	%RSD	0.8	2.4	1.2	3.9	4.0
7	avg	893.13	7.32	9.56	147.70	178.31
	stdev	2.33	0.07	0.39	2.81	3.73
	%RSD	0.3	1.0	4.1	1.9	2.1
9	avg	890.52	7.77	11.14	155.84	174.19
	stdev	8.52	0.20	0.29	5.40	5.43
	%RSD	1.0	2.6	2.6	3.5	3.1
10IL	avg	893.10	7.34	10.46	162.80	188.14
	stdev	2.85	0.09	0.15	2.39	2.63
	%RSD	0.3	1.2	1.4	1.5	1.4

Where NR = not reported
*outlying data not included in r&R calculations

1R6F

		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
10OL	avg	893.10	7.34	10.46	53.64*	73.89*
	stdev	2.85	0.09	0.15	13.44	12.57
	%RSD	0.3	1.2	1.4	25.1	17.0
11	avg	890.96	7.46	10.32	156.20	192.20
	stdev	6.94	0.11	0.19	8.47	9.86
	%RSD	0.8	1.5	1.9	5.4	5.1
13	avg	875.28	7.78	10.51	161.71	180.42
	stdev	7.78	0.08	0.23	1.64	2.81
	%RSD	0.9	1.1	2.2	1.0	1.6
15	avg	892.88	8.00	NR	137.62	155.12
	stdev	18.74	0.00	NR	13.01	11.59
	%RSD	2.1	0.0	NR	9.5	7.5

Where NR = not reported
*outlying data not included in r&R calculations

CM9

		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
1	avg	933.45	7.97	17.46	60.70	76.95
	stdev	3.45	0.12	0.23	1.47	1.95
	%RSD	0.4	1.5	1.3	2.4	2.5
2	avg	940.20	7.42	16.36	55.60	68.80
	stdev	5.54	0.08	0.57	1.52	2.39
	%RSD	0.6	1.1	3.5	2.7	3.5
3	avg	939.20	6.90	16.16	66.02	70.71
	stdev	2.59	0.00	0.29	1.86	2.03
	%RSD	0.3	0.0	1.8	2.8	2.9
4	avg	NR	7.00	NR	63.53	71.27
	stdev	NR	0.00	NR	3.33	3.46
	%RSD	NR	0.0	NR	5.2	4.9
5	avg	938.55	7.71	16.77	63.53	77.12
	stdev	1.67	0.06	0.19	1.24	1.59
	%RSD	0.2	0.7	1.1	2.0	2.1
6	avg	944.08	7.35	16.53	60.13	72.40
	stdev	5.73	0.19	0.56	3.00	3.85
	%RSD	0.6	2.6	3.4	5.0	5.3
7	avg	935.90	7.52	16.77	61.44	74.82
	stdev	8.47	0.19	0.23	2.22	3.23
	%RSD	0.9	2.5	1.4	3.6	4.3
9	avg	936.99	8.01	18.59	71.93	90.39
	stdev	9.30	0.09	0.58	1.19	1.21
	%RSD	1.0	1.2	3.1	1.6	1.3
10IL	avg	940.12	7.66	17.15	68.60	77.60
	stdev	2.37	0.10	0.16	0.89	1.04
	%RSD	0.3	1.3	0.9	1.3	1.3

Where NR = not reported
*outlying data not included in r&R calculations

CM9

		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
10OL	avg	940.12	7.66	17.15	17.83*	22.19*
	stdev	2.37	0.10	0.16	3.35	4.08
	%RSD	0.3	1.3	0.9	18.8	18.4
11	avg	932.99	7.48	16.56	63.80	85.92
	stdev	4.79	0.08	0.32	1.36	2.43
	%RSD	0.5	1.1	1.9	2.1	2.8
13	avg	924.86	7.90	18.66	77.11	86.04
	stdev	4.27	0.07	0.49	1.16	1.62
	%RSD	0.5	0.9	2.6	1.5	1.9
15	avg	926.78	9.00	NR	55.49	70.32
	stdev	21.85	0.00	NR	5.57	6.50
	%RSD	2.4	0.0	NR	10.0	9.2

Where NR = not reported
*outlying data not included in r&R calculations

Appendix C: Summarized Data – Intense

2R5F

		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
1	avg	826.60	7.83	28.21	307.99	383.50
	stdev	15.13	0.40	0.80	16.41	21.18
	%RSD	1.8	5.1	2.8	5.3	5.5
2	avg	858.40	6.96	24.72	305.60	357.80
	stdev	10.16	0.18	0.27	24.52	27.37
	%RSD	1.2	2.6	1.1	8.0	7.6
3	avg	827.60	6.90	23.09	342.05	400.03
	stdev	7.06	0.26	0.58	10.88	11.64
	%RSD	0.9	3.7	2.5	3.2	2.9
4	avg	NR	7.40	NR	362.48	410.90
	stdev	NR	0.55	NR	44.39	51.73
	%RSD	NR	7.4	NR	12.2	12.6
5	avg	836.27	7.31	23.80	300.77	369.17
	stdev	0.97	0.12	1.01	9.71	12.27
	%RSD	0.1	1.6	4.2	3.2	3.3
6	avg	824.99	7.00	26.25	312.03	388.86
	stdev	4.61	0.16	0.85	8.85	15.25
	%RSD	0.6	2.3	3.2	2.8	3.9
7	avg	836.82	7.28	25.25	305.61	387.83
	stdev	9.44	0.17	0.37	13.83	16.64
	%RSD	1.1	2.3	1.5	4.5	4.3
9	avg	829.85	8.07	32.76	353.95	388.60
	stdev	15.18	0.46	2.12	11.31	11.36
	%RSD	1.8	5.7	6.5	3.2	2.9
10IL	avg	827.38	7.35	29.57	352.60	429.00
	stdev	2.18	0.18	0.60	11.72	14.34
	%RSD	0.3	2.5	2.0	3.3	3.3

Where NR = not reported
*outlying data not included in r&R calculations

2R5F

		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
10OL	avg	827.38	7.35	29.57	181.63*	266.97*
	stdev	2.18	0.18	0.60	28.65	19.38
	%RSD	0.3	2.5	2.0	15.8	7.3
11	avg	838.81	7.68	26.54	331.40	425.20
	stdev	8.67	0.24	0.30	8.99	9.07
	%RSD	1.0	3.1	1.1	2.7	2.1
13	avg	811.40	7.82	33.66	289.00	321.54
	stdev	6.66	0.08	1.02	4.91	5.74
	%RSD	0.8	1.1	3.0	1.7	1.8
15	avg	894.92	9.00	NR	312.07	354.98
	stdev	23.85	0.00	NR	31.04	33.65
	%RSD	2.7	0.0	NR	9.9	9.5

Where NR = not reported
*outlying data not included in r&R calculations

1R6F

		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
1	avg	896.00	9.35	41.18	351.61	436.86
	stdev	9.30	0.09	1.36	15.97	19.36
	%RSD	1.0	1.0	3.3	4.5	4.4
2	avg	934.40	8.32	35.70	349.60	405.20
	stdev	16.83	0.25	1.11	11.28	13.14
	%RSD	1.8	3.0	3.1	3.2	3.2
3	avg	894.60	8.27	34.34	388.21	448.92
	stdev	6.15	0.10	0.47	13.14	16.36
	%RSD	0.7	1.2	1.4	3.4	3.6
4	avg	NR	8.40	NR	408.92	460.95
	stdev	NR	0.55	NR	38.08	42.23
	%RSD	NR	6.5	NR	9.3	9.2
5	avg	899.12	8.64	33.23	356.82	432.12
	stdev	1.98	0.29	0.37	10.39	12.50
	%RSD	0.2	3.3	1.1	2.9	2.9
6	avg	900.66	8.39	37.42	361.77	446.83
	stdev	8.53	0.37	1.35	14.37	15.73
	%RSD	0.9	4.4	3.6	4.0	3.5
7	avg	900.20	8.75	35.70	346.16	437.05
	stdev	9.80	0.22	0.78	11.55	15.54
	%RSD	1.1	2.5	2.2	3.3	3.6
9	avg	893.04	9.33	43.64	423.36	458.83
	stdev	12.09	0.41	1.46	23.41	23.24
	%RSD	1.4	4.4	3.4	5.5	5.1
10IL	avg	893.10	8.66	41.24	400.40	480.70
	stdev	2.85	0.10	0.44	3.44	4.15
	%RSD	0.3	1.2	1.1	0.9	0.9

Where NR = not reported
*outlying data not included in r&R calculations

1R6F

		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
10OL	avg	893.10	8.66	41.24	216.90*	299.74*
	stdev	2.85	0.10	0.44	16.30	46.26
	%RSD	0.3	1.2	1.1	7.5	15.4
11	avg	888.25	8.86	37.16	366.80	466.00
	stdev	3.68	0.21	0.93	14.48	15.76
	%RSD	0.4	2.3	2.5	3.9	3.4
13	avg	890.30	8.68	45.49	346.27	384.71
	stdev	8.27	0.08	1.73	7.63	8.20
	%RSD	0.9	1.0	3.8	2.2	2.1
15	avg	961.34	9.00	NR	325.67	371.96
	stdev	16.20	0.00	NR	19.55	22.28
	%RSD	1.7	0.0	NR	6.0	6.0

Where NR = not reported
*outlying data not included in r&R calculations

CM9

		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
1	avg	927.80	11.25	42.70	116.70	141.39
	stdev	10.85	0.42	1.49	7.26	7.68
	%RSD	1.2	3.8	3.5	6.2	5.4
2	avg	979.00	10.32	40.38	112.00	121.00
	stdev	7.35	0.22	1.01	0.00	0.00
	%RSD	0.8	2.1	2.5	0.0	0.0
3	avg	938.00	9.70	37.76	134.50	143.62
	stdev	4.42	0.17	0.25	3.54	4.21
	%RSD	0.5	1.7	0.7	2.6	2.9
4	avg	NR	NR	NR	NR	NR
	stdev	NR	NR	NR	NR	NR
	%RSD	NR	NR	NR	NR	NR
5	avg	940.98	10.90	39.85	125.55	147.77
	stdev	4.98	0.24	0.19	5.70	7.81
	%RSD	0.5	2.2	0.5	4.5	5.3
6	avg	938.48	10.44	41.36	127.43	151.98
	stdev	1.94	0.13	0.31	2.34	2.57
	%RSD	0.2	1.2	0.7	1.8	1.7
7	avg	934.74	10.49	39.08	119.45	143.62
	stdev	11.34	0.21	0.47	2.03	3.21
	%RSD	1.2	2.0	1.2	1.7	2.2
9	avg	939.91	11.36	45.27	155.12	191.92
	stdev	12.67	0.45	2.22	12.44	12.41
	%RSD	1.3	3.9	4.9	8.0	6.5
10IL	avg	940.12	10.92	42.82	138.40	150.64
	stdev	2.37	0.07	0.75	1.34	1.76
	%RSD	0.3	0.6	1.7	1.0	1.2

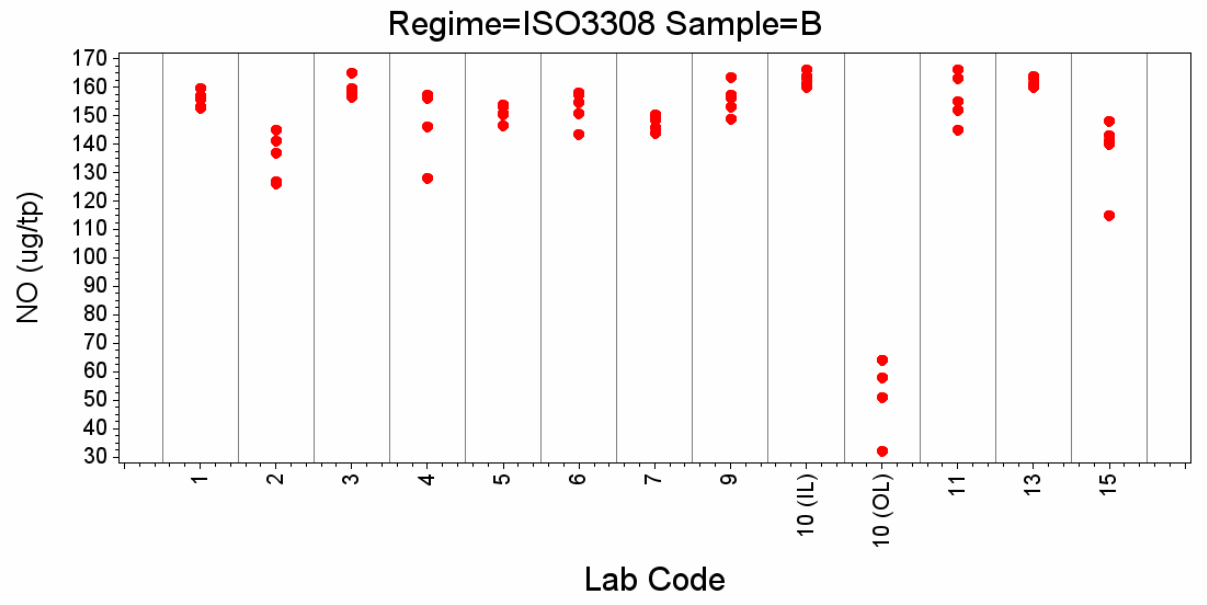
Where NR = not reported
*outlying data not included in r&R calculations

CM9

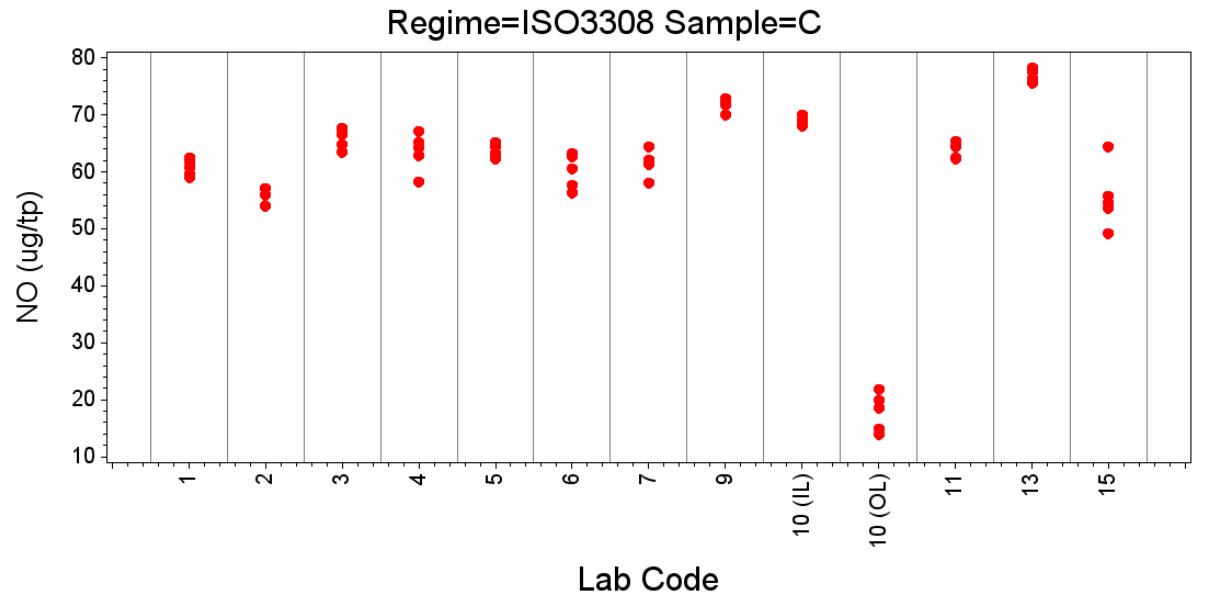
		Conditioned Wt	Puff Count	MS TPM	NO	NOx
Lab Code		(mg per cig)	(/cig)	(mg/cig)	(µg/cig)	(µg/cig)
10OL	avg	940.12	10.92	42.82	78.44*	91.03*
	stdev	2.37	0.07	0.75	3.47	5.10
	%RSD	0.3	0.6	1.7	4.4	5.6
11	avg	935.74	10.70	41.96	127.20	170.00
	stdev	4.03	0.19	0.65	8.53	12.75
	%RSD	0.4	1.7	1.5	6.7	7.5
13	avg	933.24	10.42	48.33	185.54	206.65
	stdev	9.03	0.08	1.33	6.23	7.66
	%RSD	1.0	0.8	2.7	3.4	3.7
15	avg	988.92	12.00	NR	96.38	125.01
	stdev	27.85	0.00	NR	7.18	7.79
	%RSD	2.8	0.0	NR	7.4	6.2

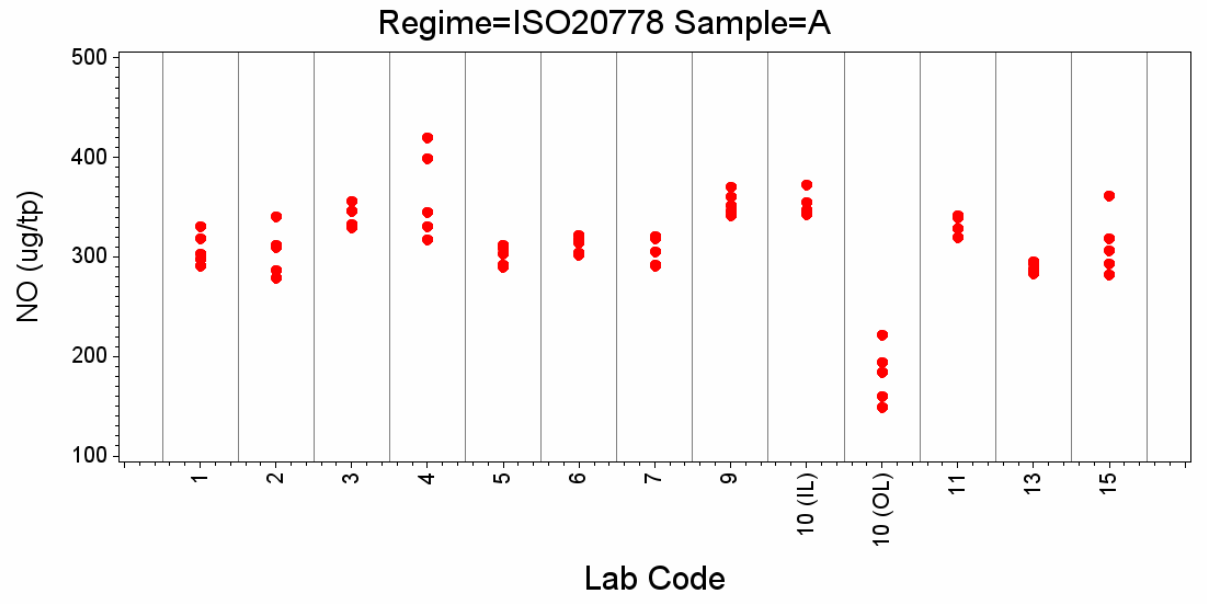
Where NR = not reported
*outlying data not included in r&R calculations

Appendix D: Data Graphs

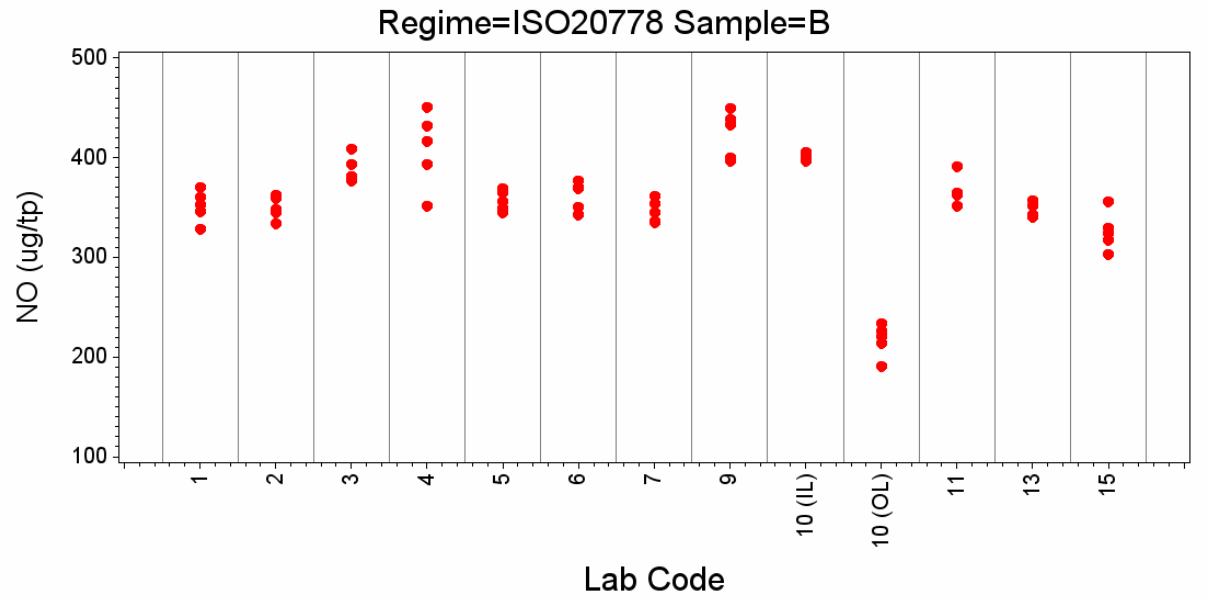


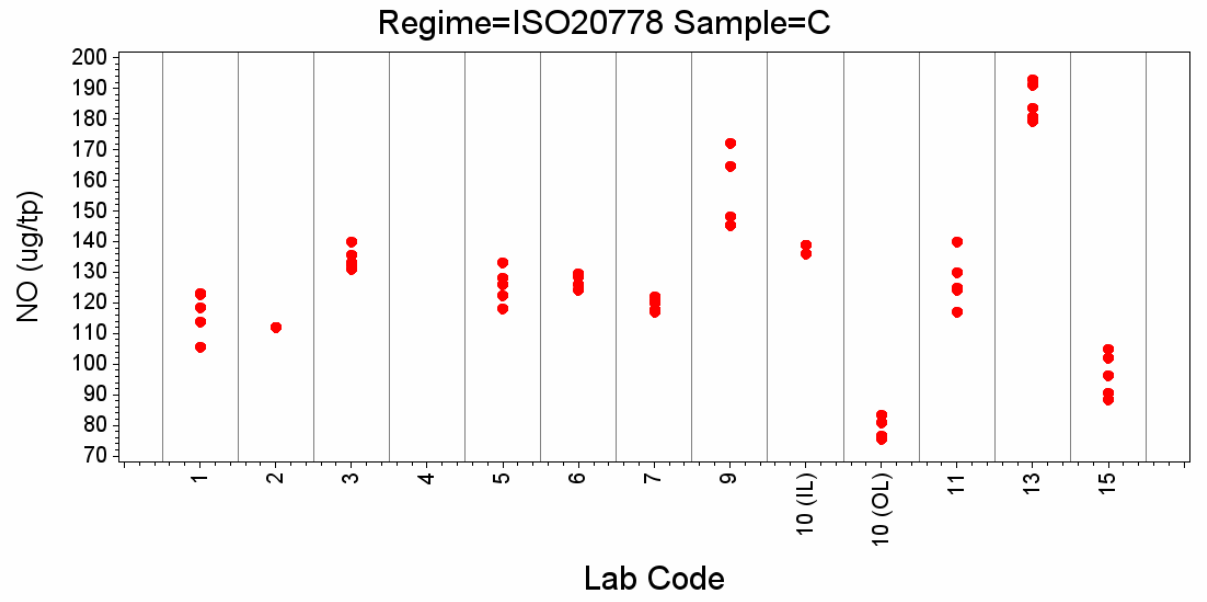
Where data are reported µg/tp (test piece); breaks in Lab Code values are due to non-reporting laboratories or laboratories that withdrew from the study after code assignment but prior to reporting.



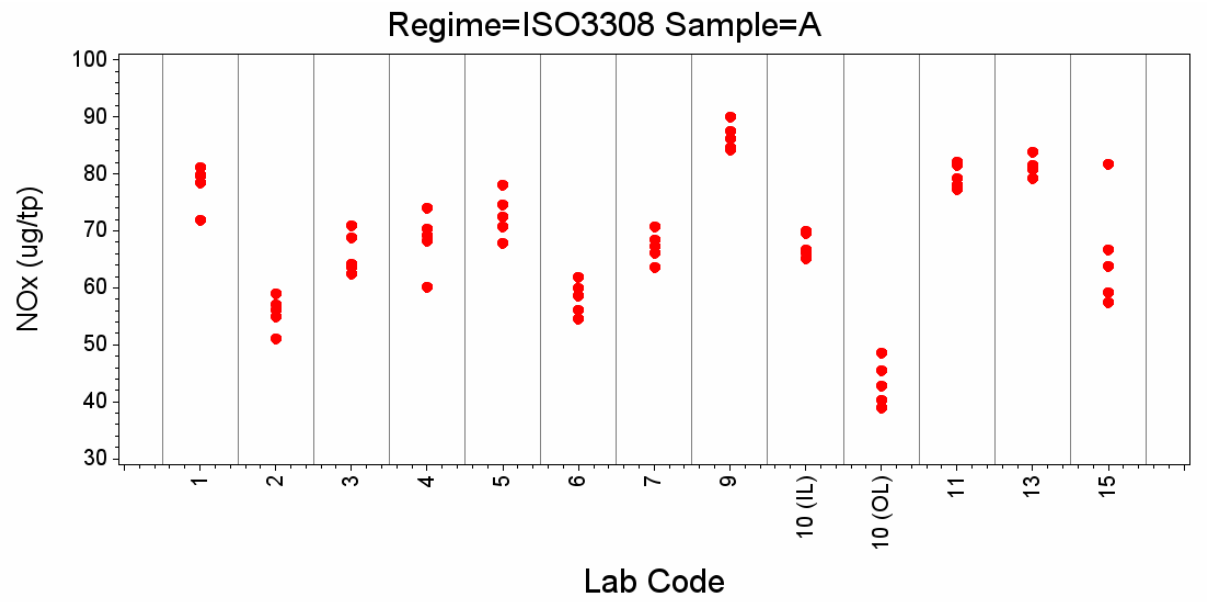


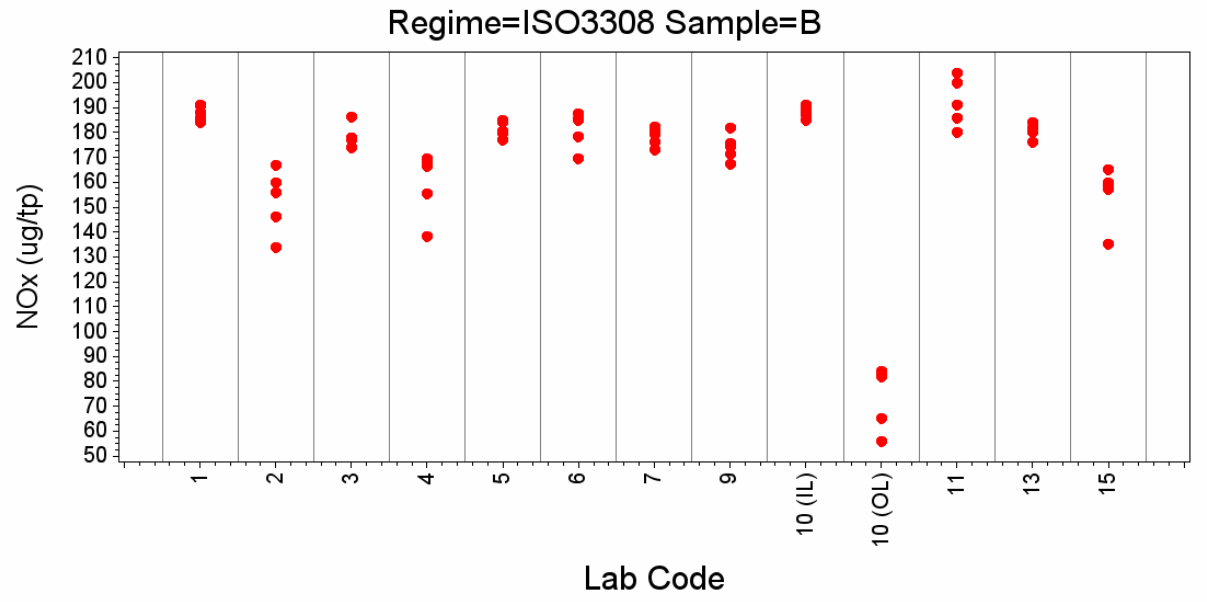
Where data are reported µg/tp (test piece); breaks in Lab Code values are due to non-reporting laboratories or laboratories that withdrew from the study after code assignment but prior to reporting.



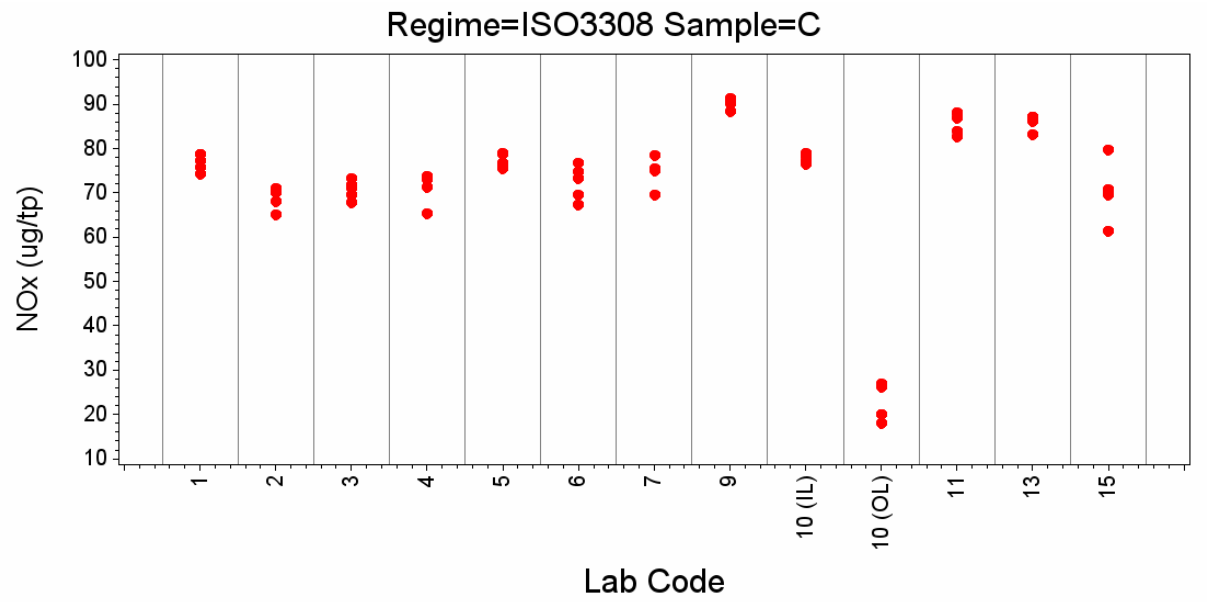


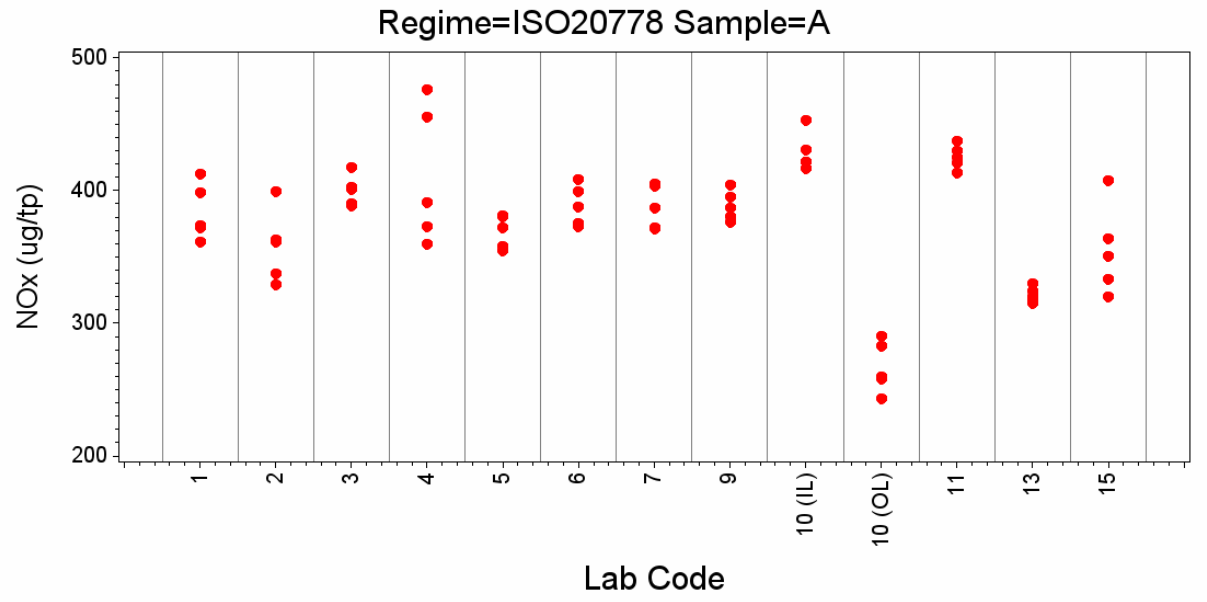
Where data are reported µg/tp (test piece); breaks in Lab Code values are due to non-reporting laboratories or laboratories that withdrew from the study after code assignment but prior to reporting.



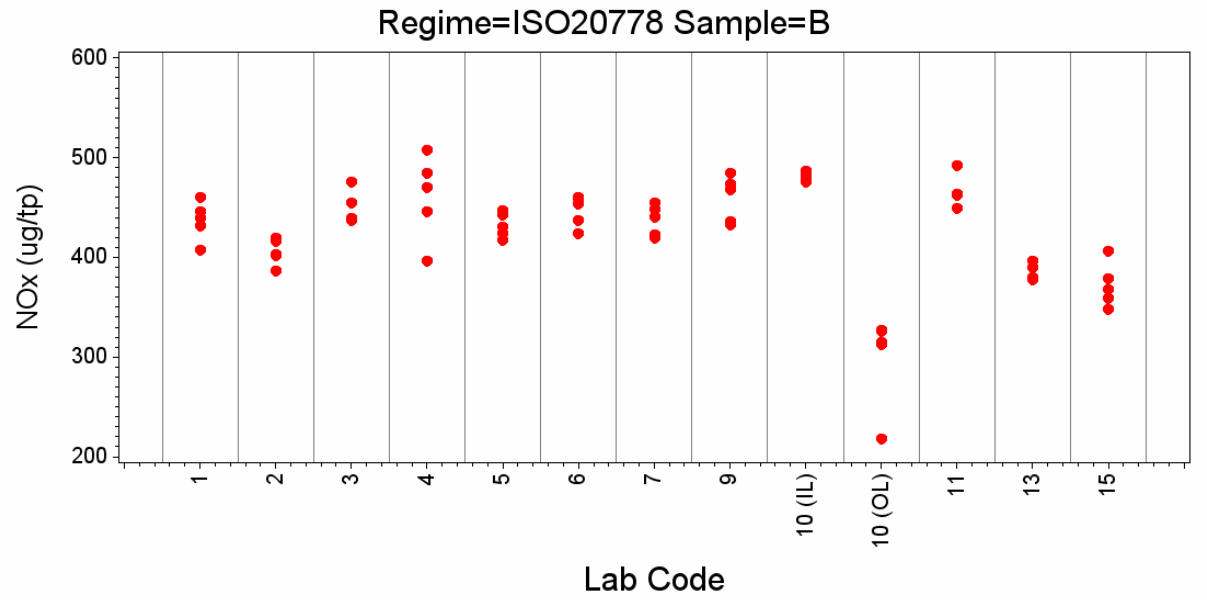


Where data are reported µg/tp (test piece); breaks in Lab Code values are due to non-reporting laboratories or laboratories that withdrew from the study after code assignment but prior to reporting.





Where data are reported µg/tp (test piece); breaks in Lab Code values are due to non-reporting laboratories or laboratories that withdrew from the study after code assignment but prior to reporting.



Where data are reported µg/tp (test piece); breaks in Lab Code values are due to non-reporting laboratories or laboratories that withdrew from the study after code assignment but prior to reporting.

Appendix E: Method Details

Smoking, Trapping & Extraction

Smoking			
Lab Number	**Smoking Machine Style**	**Make**	**# Cigarettes**
1	Rotary Smoking Machine	Borgwaldt RM20H	10 and 3
2	Rotatory Smoke Machine	RM200A	5
3	Rotary Smoking Machine	RM20D	20 and 10
4	Single Port Smoking Machine	Borgwaldt	1
5	Rotary smoking machine	BKCH RM20H	10 and 5
6	Rotary Smoking Machine	Borgwaldt RM20D	20 and 10
7	Rotary Smoking Machine	Borgwaldt RM20H	10 and 5
9	Linear Smoking Machine	LC20X PLUS	5 and 2
10IL	Rotary Smoking Machine	Borgwaldt RM20H2	20 and 10
10OL	Rotary Smoking Machine	Borgwaldt RM20H2	20 and 10
11	Rotary Smoking Machine	Borgwardt RM20H	10 and 5
13	Linear Smoking Machine	Cerulean SM450	1
15	RM1/G Single Port Smoking Machine	Borgwaldt	1
Trapping & Extraction			
Lab Number	**Particulate Trap**	**Gas Phase Trap (style and temp)**	**Filter Pad / Diameter**
1	NR	in-line, no trap	NR
2	NR	in-line, no trap	92 mm
3	NR	in-line, no trap	NR
4	NR	in-line, no trap	CFP 44 mm
5	NR	in-line, no trap	NR
6	NR	in-line, no trap	CFP 92 mm
7	92mm metal	in-line, no trap	CFP 92 mm
9	44mm plastic	Borgwaldt gas collection bag, 10L	CFP 44mm
10IL	NR	in-line, no trap	NR
10OL	NR	gas collection bag 10l	NR
11	92mm metal	in-line, no trap	CFP 92mm
13	NR	flat-bottomed flask, 1L	CFP 44 mm
15	NR	Round bottomed 3 neck boiling flasks, 5L or 6L	CFP 44 mm

Analysis

Analysis				
Lab Number	**Instrument**	**In-line or Off-line**	**Detection Type**	**Mode**
1	Eco Physics CLD822mH	In-Line	Chemiluminescence	NO / NO_2 / NOx
2	Eco Physics CLD822mH	In-Line	Chemiluminescence	NO / NOx
3	Eco Physics CLD 822 MH	In-Line	Chemiluminescence	NO / NO_2 / NOx
4	California Analytics 700 CLD	In-Line	Chemiluminescence	NOx, Separate instrument used for NO and NOx measurements
5	Eco Physics CLD822mH	In-line	Chemiluminescence	NO / NO_2 / NOx
6	Eco Physics CLD822mH	In-Line	Chemiluminescence	NO / NO_2 / NOx
7	Eco Physics CLD822Mhk1	In-Line	Chemiluminescence	NO / NO_2 / NOx
9	Eco Physics CLD844	Off-Line	Chemiluminescence	NO/NOx
10IL	Eco Physics CLD822m h	In-Line	Chemiluminescence	NO / NO_2 / NOx
10OL	Eco Physics CLD822m h	Off-Line	Chemiluminescence	NO / NO_2 / NOx
11	Eco Physics CLD822mh	In-Line	Chemiluminescence	NO / NO_2 / NOx
13	Thermo 42i	In-Line	Chemiluminescence	NO / NOx
15	Dual Channel Real Time Chemiluminescence Nitrogen Oxides Analyzer	In-Line	Chemiluminescence	NO / NOx

Quantitation Information

Quantitation Information						
Lab Number	**Limit of Quantitation**	**Limit of Detection**	**Method Uncertainty**	**Number of Standards**	**Concentration of each Standard**	**Calibration Type**
1	Non-Intense NO: 3.03 µg/cig NOx: 4.65 µg/cig Intense NO: 4.77 µg/cig NOx: 7.31 µg/cig	Non-Intense NO: 0.91 µg/cig NOx: 1.40 µg/cig Intense NO: 1.43 µg/cig NOx: 2.19 µg/cig	0.292	4	0 ppm 100 ppm 400 ppm 1000 ppm	Linear
2	Non-intense 0.034 Intense 0.186	Non-intense 0.010 Intense 0.056	bottom up	1	Non-intense 700ppm Intense 1500 ppm	NA
3	NR	NR	NR	1	1500 ppm	Linear
4	0.024405781	0.002642358	Non-Intense NO: 17.7 % NOx: 18.3 % Intense NO: 9.8 % NOx: 14.1 %	6	1950, 1500,1000, 500,100, 0 ppm	Non weighted linear
5	Non-Intense NO/NOx: 325 Intense NO/NOx: 511	Non-Intense NO/NOx: 99 Intense NO/NOx: 155	± 1.84	3	100 - 800 - 1500	Multiple point of calibration
6	0.001 mg/cig	0.0003 mg/cig	NR	2	0.0 µmol/mol 1006.0 µmol/mol	Linear
7	Non-Intense: 0.906 ug/cig Intense: 1.424 ug/cig	Non-Intense: 0.275 ug/cig Intense: 0.431 ug/cig	NR	2	P1 = 0 P2 = 1512,0	Linear
9	NO 0.01184 NO2 0.03731	NO 0.00355 NO2 0.01119	± 0.5 ppb	1	80 ppm	NA
10IL	NR	0,005 % of FS	NR	3	0 ppm, 50 ppm , 400 ppm NO/NOx	Linear
10OL	NR	0,005 % of FS	NR	3	0 ppm, 50 ppm , 400 ppm NO/NOx	Linear
11	ISO:3.40 µg/cig	ISO:1.02 µg/cig	NR	One point calibration Forced to through origin	1000 ppm	Linear regression
13	0.0000012	0.00000035	NR	6	0.470, 0.957, 2.248, 3.682, 6.674, 13.500	Linear
15	Non-intense NO 2.70 NOx 7.52 Intense NO 12.2 NOx 18.2	Non-intense NO 0.810 NOx 2.26 Intense NO 3.63 NOx 7.01	NO±6.8 % NOx±6.4 %	4	Non-intense 100, 250, 500, 1000 ppm Intense 150, 250, 500, 1000 ppm	Linear

Appendix F: Raw Data Non-Intense (IS0 3308)

2R5F

Lab Code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
1	A	1	10	827.91	8.25	2.79	72.17	79.88	
1	A	2	10	830.58	8.21	2.61	73.60	81.10	
1	A	3	10	820.50	8.19	2.51	71.35	78.49	0
1	A	4	10	833.83	8.08	2.29	65.62	71.85	
1	A	5	10	825.47	8.20	2.48	72.41	79.64	
2	A	1	5	829.00	7.80	2.30	55.00	55.00	
2	A	2	5	831.00	8.10	2.10	55.00	56.00	
2	A	3	5	837.00	7.90	2.00	57.00	59.00	1
2	A	4	5	823.00	7.30	2.20	54.00	57.00	
2	A	5	5	826.00	7.30	2.30	52.00	51.00	
3	A	1	20	829.00	7.1	2.27	62.98	63.68	
3	A	2	20	827.00	7.2	2.20	63.52	64.21	
3	A	3	20	832.00	7.3	2.14	61.46	62.45	0
3	A	4	20	824.00	7.0	2.29	67.31	68.76	
3	A	5	20	831.00	7.2	2.30	68.85	70.88	
4	A	1	1	NR1	7.0	NA	65.82	68.31	
4	A	2	1	NR1	8.0	NA	68.09	70.30	
4	A	3	1	NR1	7.0	NA	57.54	60.22	0
4	A	4	1	NR1	7.0	NA	65.49	69.18	
4	A	5	1	NR1	7.0	NA	70.44	73.92	
5	A	1	10	825.06	7.84	2.59	66.05	72.45	
5	A	2	10	836.81	8.00	2.60	64.90	70.65	
5	A	3	10	828.76	7.86	2.64	68.24	74.53	0
5	A	4	10	838.87	7.91	2.50	62.77	67.84	
5	A	5	10	840.67	7.99	2.60	72.01	77.98	
6	A	1	20	832.53	7.4	2.32	58.47	61.89	
6	A	2	20	831.73	7.4	1.91	55.30	58.54	
6	A	3	20	826.28	7.6	2.38	56.58	59.96	2
6	A	4	20	827.43	7.4	2.22	52.03	54.58	
6	A	5	20	822.65	7.3	2.24	53.34	56.11	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations

2R5F

Lab Code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
7	A	1	10	824.49	7.61	2.56	65.011	70.722	
7	A	2	10	831.99	7.95	2.31	61.349	66.120	
7	A	3	10	838.47	8.05	2.41	62.288	67.193	0
7	A	4	10	807.96	7.51	2.36	58.819	63.534	
7	A	5	10	834.78	7.96	2.34	63.414	68.459	
9	A	1	5	829.96	8.2	2.68	67.52	86.05	
9	A	2	5	848.72	8.7	2.78	68.76	87.51	
9	A	3	5	818.48	8.2	2.86	71.52	90.06	0
9	A	4	5	830.74	8.9	2.80	65.79	84.61	
9	A	5	5	814.04	8.1	2.80	65.71	84.21	
10IL	A	1	20	828.98	7.9	2.2	61.5	65.2	
10IL	A	2	20	823.57	7.8	2.5	62.2	66.1	
10IL	A	3	20	828.50	7.8	2.4	65.6	69.6	0
10IL	A	4	20	828.16	7.7	2.4	65.7	70.0	
10IL	A	5	20	827.70	7.8	2.3	63.0	66.6	
10OL	A	1	20	828.98	7.9	2.2	35.2*	38.9*	
10OL	A	2	20	823.57	7.8	2.5	40.9*	45.5*	
10OL	A	3	20	828.50	7.8	2.4	40.4*	48.6*	0
10OL	A	4	20	828.16	7.7	2.4	35.6*	40.2*	
10OL	A	5	20	827.70	7.8	2.3	37.0*	42.7*	
11	A	1	10	841.29	8.0	2.5	69.1	78.0	
11	A	2	10	839.18	8.0	2.5	69.1	77.3	
11	A	3	10	838.07	8.2	2.6	70.6	79.2	0
11	A	4	10	841.07	8.0	2.8	72.2	81.6	
11	A	5	10	836.24	8.1	2.9	72.3	82.1	
13	A	1	1	804.20	8.0	2.4	74.1	81.6	
13	A	2	1	817.40	8.1	2.6	70.6	79.3	
13	A	3	1	805.30	8.2	2.3	74.3	83.8	5
13	A	4	1	819.30	8.1	2.3	74.0	81.3	
13	A	5	1	806.20	8.1	2.4	71.7	80.8	
15	A	1	1	815.90	8.0	NA	49.2	59.2	
15	A	2	1	817.80	8.0	NA	69.4	81.7	
15	A	3	1	802.50	8.0	NA	52.6	63.8	0
15	A	4	1	818.70	8.0	NA	55.6	66.7	
15	A	5	1	887.60	8.0	NA	46.4	57.4	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations

1R6F

Lab Code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
1	B	1	10	889.34	7.9	10.34	159.46	190.94	
1	B	2	10	896.16	7.7	10.16	152.72	184.09	
1	B	3	10	881.32	7.8	10.85	155.71	187.81	0
1	B	4	10	891.41	7.6	9.87	153.11	185.94	
1	B	5	10	888.56	7.8	10.24	156.84	190.88	
2	B	1	5	889.00	7.1	10.00	145.00	167.00	
2	B	2	5	899.00	7.3	10.10	141.00	160.00	
2	B	3	5	886.00	7.2	10.20	126.00	146.00	1
2	B	4	5	896.00	7.2	10.20	137.00	156.00	
2	B	5	5	897.00	7.3	9.50	127.00	134.00	
3	B	1	20	888.00	6.7	9.73	157.28	173.76	
3	B	2	20	885.00	6.8	9.82	159.53	177.74	
3	B	3	20	894.00	6.8	9.82	156.66	176.85	0
3	B	4	20	894.00	6.7	9.54	165.05	186.05	
3	B	5	20	895.00	6.9	9.89	158.73	178.09	
4	B	1	1	NR1	7.0	NA	155.98	166.30	
4	B	2	1	NR1	7.0	NA	156.92	167.62	
4	B	3	1	NR1	7.0	NA	128.07	138.20	0
4	B	4	1	NR1	7.0	NA	157.44	169.33	
4	B	5	1	NR1	7.0	NA	146.07	155.56	
5	B	1	10	889.23	7.43	9.75	150.21	179.84	
5	B	2	10	888.65	7.41	9.81	150.60	180.47	
5	B	3	10	898.04	7.32	9.81	146.56	177.09	0
5	B	4	10	898.92	7.44	9.93	153.96	185.02	
5	B	5	10	892.94	7.52	9.99	153.03	184.00	
6	B	1	20	910.42	7.2	10.29	157.41	185.60	
6	B	2	20	908.56	7.1	10.16	154.69	185.03	
6	B	3	20	898.43	7.3	10.33	158.17	187.46	2
6	B	4	20	907.78	7.5	10.33	150.78	178.29	
6	B	5	20	895.21	7.0	10.50	143.49	169.68	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations

1R6F

Lab Code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
7	B	1	10	893.39	7.23	9.48	150.366	180.792	
7	B	2	10	891.16	7.33	9.72	148.460	179.196	
7	B	3	10	890.38	7.27	9.18	143.822	172.973	0
7	B	4	10	895.69	7.41	10.15	150.022	182.311	
7	B	5	10	895.05	7.37	9.27	145.817	176.291	
9	B	1	5	879.14	7.6	11.32	156.11	174.41	
9	B	2	5	894.32	8.0	11.22	163.54	181.98	
9	B	3	5	889.66	7.9	11.38	157.48	175.87	0
9	B	4	5	902.16	7.9	10.66	149.01	167.42	
9	B	5	5	887.32	7.5	11.12	153.05	171.28	
10IL	B	1	20	894.52	7.3	10.6	164	190	
10IL	B	2	20	891.61	7.3	10.3	161	187	
10IL	B	3	20	889.32	7.3	10.4	166	191	0
10IL	B	4	20	896.83	7.4	10.4	163	188	
10IL	B	5	20	893.24	7.5	10.6	160	185	
10OL	B	1	20	894.52	7.3	10.6	51*	65*	
10OL	B	2	20	891.61	7.3	10.3	64*	83*	
10OL	B	3	20	889.32	7.3	10.4	32*	56*	0
10OL	B	4	20	896.83	7.4	10.4	64*	84*	
10OL	B	5	20	893.24	7.5	10.6	58*	82*	
11	B	1	10	890.06	7.3	10.2	145	180	
11	B	2	10	879.84	7.4	10.4	152	186	
11	B	3	10	895.63	7.5	10.1	163	200	0
11	B	4	10	897.73	7.6	10.3	155	191	
11	B	5	10	891.56	7.5	10.6	166	204	
13	B	1	1	885.70	7.8	10.7	160	176	
13	B	2	1	880.40	7.7	10.5	163	180	
13	B	3	1	872.60	7.8	10.8	160	180	5
13	B	4	1	865.90	7.7	10.2	164	184	
13	B	5	1	871.80	7.9	10.5	161	182	
15	B	1	1	889.90	8.0	NA	115	135	
15	B	2	1	918.00	8.0	NA	148	165	
15	B	3	1	904.70	8.0	NA	143	160	0
15	B	4	1	871.00	8.0	NA	141	157	
15	B	5	1	880.80	8.0	NA	140	159	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations

CM9

Lab Code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
1	C	1	10	935.59	7.9	17.41	62.54	78.78	
1	C	2	10	932.13	8.0	17.56	58.94	74.24	
1	C	3	10	934.35	7.8	17.09	61.65	78.69	0
1	C	4	10	936.99	8.1	17.62	60.76	77.25	
1	C	5	10	928.17	8.0	17.64	59.60	75.77	
2	C	1	5	940.00	7.4	16.40	57.00	71.00	
2	C	2	5	935.00	7.3	16.20	54.00	68.00	
2	C	3	5	936.00	7.4	17.20	56.00	70.00	1
2	C	4	5	949.00	7.5	15.60	54.00	65.00	
2	C	5	5	941.00	7.5	16.40	57.00	70.00	
3	C	1	20	941.00	6.9	16.44	67.77	71.68	
3	C	2	20	942.00	6.9	16.09	64.89	69.67	
3	C	3	20	940.00	6.9	15.81	63.39	67.85	0
3	C	4	20	937.00	6.9	16.49	67.53	73.18	
3	C	5	20	936.00	6.9	15.99	66.50	71.15	
4	C	1	1	NR1	7.0	NA	67.17	73.19	
4	C	2	1	NR1	7.0	NA	58.27	65.32	
4	C	3	1	NR1	7.0	NA	65.12	72.96	0
4	C	4	1	NR1	7.0	NA	62.83	71.17	
4	C	5	1	NR1	7.0	NA	64.24	73.70	
5	C	1	10	937.20	7.79	17.04	65.16	78.87	
5	C	2	10	941.44	7.72	16.70	63.33	76.68	
5	C	3	10	938.32	7.63	16.60	62.38	75.38	0
5	C	4	10	937.65	7.69	16.89	64.41	78.70	
5	C	5	10	938.15	7.71	16.64	62.36	75.96	
6	C	1	20	940.68	7.4	16.87	63.16	76.83	
6	C	2	20	953.97	7.7	17.10	62.74	74.80	
6	C	3	20	939.73	7.2	16.79	60.63	73.37	2
6	C	4	20	942.47	7.3	15.79	56.38	67.37	
6	C	5	20	943.55	7.2	16.11	57.76	69.62	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations

CM9

Lab code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
7	C	1	10	938.21	7.55	16.60	58.126	69.626	
7	C	2	10	924.59	7.28	16.97	61.406	75.025	
7	C	3	10	945.98	7.76	17.06	64.326	78.548	0
7	C	4	10	940.43	7.63	16.65	62.096	75.539	
7	C	5	10	930.29	7.40	16.57	61.265	75.359	
9	C	1	5	944.32	8.0	18.30	72.30	90.74	
9	C	2	5	936.48	7.9	18.08	70.01	88.43	
9	C	3	5	947.20	8.1	18.30	72.98	91.47	0
9	C	4	5	933.12	7.9	18.74	71.65	90.07	
9	C	5	5	923.84	8.1	19.54	72.71	91.22	
10IL	C	1	20	942.03	7.8	17.2	69.0	78.3	
10IL	C	2	20	937.04	7.6	17.3	68.0	77.2	
10IL	C	3	20	942.24	7.7	16.9	70.0	79.0	0
10IL	C	4	20	941.16	7.7	17.3	68.0	76.4	
10IL	C	5	20	938.16	7.5	17.1	68.0	77.1	
10OL	C	1	20	942.03	7.8	17.2	19.9*	19.9*	
10OL	C	2	20	937.04	7.6	17.3	13.9*	17.9*	
10OL	C	3	20	942.24	7.7	16.9	21.8*	27.0*	0
10OL	C	4	20	941.16	7.7	17.3	14.9*	20.0*	
10OL	C	5	20	938.16	7.5	17.1	18.6*	26.1*	
11	C	1	10	935.28	7.5	16.2	64.5	88.0	
11	C	2	10	939.95	7.5	16.3	62.4	82.8	
11	C	3	10	927.87	7.4	16.7	62.3	83.9	0
11	C	4	10	929.62	7.4	16.6	65.3	88.1	
11	C	5	10	932.23	7.6	17.0	64.5	86.8	
13	C	1	1	920.50	7.9	19.1	75.5	83.3	
13	C	2	1	927.40	8.0	19.1	78.0	87.1	
13	C	3	1	921.70	7.8	18.9	77.5	87.2	5
13	C	4	1	923.80	7.9	18.0	76.3	86.5	
13	C	5	1	930.90	7.9	18.2	78.3	86.1	
15	C	1	1	915.10	9.0	NA	64.4	79.6	
15	C	2	1	945.30	9.0	NA	49.2	61.3	
15	C	3	1	894.50	9.0	NA	55.8	70.7	0
15	C	4	1	945.20	9.0	NA	54.5	69.5	
15	C	5	1	933.80	9.0	NA	53.6	70.4	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations

Appendix G: Raw Data Intense (ISO 20778)

2R5F

Lab Code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
1	A	1	3	816.00	8.2	27.07	302.77	373.62	
1	A	2	3	808.00	7.4	28.50	290.40	361.07	
1	A	3	3	847.00	8.1	29.23	330.78	412.33	0
1	A	4	3	832.00	8.1	28.37	318.51	398.57	
1	A	5	3	830.00	7.4	27.87	297.48	371.91	
2	A	1	5	866.00	7.2	24.50	310.00	363.00	
2	A	2	5	861.00	7.1	24.90	341.00	399.00	
2	A	3	5	843.00	6.8	25.10	286.00	337.00	0
2	A	4	5	868.00	6.9	24.50	312.00	361.00	
2	A	5	5	854.00	6.8	24.60	279.00	329.00	
3	A	1	10	821.00	6.6	22.40	346.40	400.82	
3	A	2	10	825.00	6.9	23.80	346.21	402.73	
3	A	3	10	833.00	7.1	23.45	332.86	390.10	0
3	A	4	10	822.00	6.7	22.61	329.11	388.85	
3	A	5	10	837.00	7.2	23.18	355.65	417.65	
4	A	1	1	NR1	7.0	NA	345.34	390.97	
4	A	2	1	NR1	8.0	NA	419.53	476.02	
4	A	3	1	NR1	7.0	NA	317.73	359.37	0
4	A	4	1	NR1	7.0	NA	330.85	372.90	
4	A	5	1	NR1	8.0	NA	398.93	455.22	
5	A	1	5	835.14	7.32	24.64	308.56	381.25	
5	A	2	5	837.14	7.14	22.96	291.65	357.71	
5	A	3	5	837.42	7.32	22.58	289.86	354.98	0
5	A	4	5	835.94	7.48	23.94	311.31	379.93	
5	A	5	5	835.70	7.30	24.86	302.50	371.98	
6	A	1	10	826.03	6.8	25.26	317.83	399.65	
6	A	2	10	819.60	7.0	27.58	314.54	388.06	
6	A	3	10	831.44	7.1	26.22	322.11	408.27	2
6	A	4	10	821.59	7.0	26.25	301.79	375.74	
6	A	5	10	826.29	7.2	25.92	303.85	372.60	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations

2R5F

Lab Code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
7	A	1	5	842.84	7.26	25.04	304.926	387.343	
7	A	2	5	828.18	7.42	25.60	292.513	370.869	
7	A	3	5	848.62	7.24	25.58	320.376	405.491	0
7	A	4	5	826.56	7.04	24.72	291.423	371.798	
7	A	5	5	837.92	7.46	25.32	318.810	403.666	
9	A	1	2	842.40	8.1	34.10	369.85	404.52	
9	A	2	2	819.30	8.9	30.25	351.58	386.73	
9	A	3	2	809.80	7.8	33.20	360.51	394.98	0
9	A	4	2	832.25	7.9	35.30	345.99	380.53	
9	A	5	2	845.50	7.7	30.95	341.82	376.22	
10IL	A	1	10	828.98	7.2	28.95	343.00	417.00	
10IL	A	2	10	823.57	7.4	29.83	372.00	453.00	
10IL	A	3	10	828.50	7.4	28.90	346.00	422.00	0
10IL	A	4	10	828.16	7.6	30.01	347.00	422.00	
10IL	A	5	10	827.70	7.2	30.14	355.00	431.00	
10OL	A	1	10	828.98	7.2	28.95	184.06*	258.32*	
10OL	A	2	10	823.57	7.4	29.83	221.46*	283.19*	
10OL	A	3	10	828.50	7.4	28.90	160.19*	259.97*	0
10OL	A	4	10	828.16	7.6	30.01	148.71*	243.05*	
10OL	A	5	10	827.70	7.2	30.14	193.75*	290.29*	
11	A	1	5	826.82	7.4	26.8	328	425	
11	A	2	5	845.08	7.8	26.2	339	430	
11	A	3	5	835.98	7.5	26.9	328	421	0
11	A	4	5	837.02	7.7	26.4	320	413	
11	A	5	5	849.14	8.0	26.4	342	437	
13	A	1	1	801.70	7.8	35.13	283.14	315.26	
13	A	2	1	811.70	7.7	32.45	292.56	324.14	
13	A	3	1	815.60	7.9	33.60	287.38	317.89	5
13	A	4	1	808.90	7.8	34.10	286.54	320.45	
13	A	5	1	819.10	7.9	33.05	295.38	329.97	
15	A	1	1	900.10	9.0	NA	281.64	319.71	
15	A	2	1	903.60	9.0	NA	361.84	407.22	
15	A	3	1	902.00	9.0	NA	318.18	363.76	0
15	A	4	1	853.60	9.0	NA	292.65	333.53	
15	A	5	1	915.30	9.0	NA	306.04	350.70	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations

1R6F

Lab Code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
1	B	1	3	888.00	9.4	40.90	360.00	445.79	
1	B	2	3	898.00	9.4	40.53	370.63	459.96	
1	B	3	3	909.00	9.4	39.40	327.95	407.76	0
1	B	4	3	899.00	9.4	42.47	346.47	431.23	
1	B	5	3	886.00	9.2	42.60	353.02	439.56	
2	B	1	5	922.00	8.3	34.90	345.00	402.00	
2	B	2	5	939.00	8.1	34.70	359.00	416.00	
2	B	3	5	957.00	8.7	36.80	362.00	419.00	0
2	B	4	5	940.00	8.4	35.10	334.00	386.00	
2	B	5	5	914.00	8.1	37.00	348.00	403.00	
3	B	1	10	890.00	8.2	34.21	380.77	439.65	
3	B	2	10	890.00	8.2	34.49	381.25	437.42	
3	B	3	10	894.00	8.2	33.58	377.01	437.83	0
3	B	4	10	894.00	8.3	34.65	409.18	475.40	
3	B	5	10	905.00	8.4	34.77	392.84	454.28	
4	B	1	1	NR1	9.0	NA	450.56	507.26	
4	B	2	1	NR1	8.0	NA	351.81	396.95	
4	B	3	1	NR1	8.0	NA	431.56	484.91	0
4	B	4	1	NR1	8.0	NA	393.76	445.63	
4	B	5	1	NR1	9.0	NA	416.89	470.02	
5	B	1	5	900.14	8.62	33.22	344.39	417.40	
5	B	2	5	901.24	8.96	32.90	369.49	447.27	
5	B	3	5	899.10	8.54	33.14	356.04	430.40	0
5	B	4	5	895.94	8.22	33.04	349.49	423.40	
5	B	5	5	899.16	8.85	33.86	364.71	442.11	
6	B	1	10	897.33	8.2	37.18	368.78	460.30	
6	B	2	10	912.70	8.8	36.80	376.55	458.97	
6	B	3	10	904.37	8.8	39.67	370.24	453.83	2
6	B	4	10	889.74	7.9	36.07	342.85	424.17	
6	B	5	10	899.18	8.3	37.36	350.45	436.88	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations

1R6F

Lab Code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
7	B	1	5	889.66	8.40	35.70	361.848	454.709	
7	B	2	5	891.26	8.90	36.20	336.040	423.022	
7	B	3	5	900.08	8.68	35.36	334.753	419.002	0
7	B	4	5	909.44	8.80	34.62	344.736	440.548	
7	B	5	5	910.58	8.96	36.64	353.430	447.990	
9	B	1	2	879.40	9.2	43.25	432.52	467.91	
9	B	2	2	907.95	9.0	44.45	437.92	473.17	
9	B	3	2	883.00	9.2	45.20	449.15	484.54	0
9	B	4	2	901.75	10.1	43.95	396.83	432.77	
9	B	5	2	893.10	9.2	41.35	400.39	435.77	
10IL	B	1	10	894.52	8.7	41.37	399.00	476.00	
10IL	B	2	10	891.61	8.6	41.38	403.00	483.00	
10IL	B	3	10	889.32	8.8	40.65	398.00	480.00	0
10IL	B	4	10	896.83	8.8	41.80	397.00	478.00	
10IL	B	5	10	893.24	8.6	40.99	405.00	486.50	
10OL	B	1	10	894.52	8.7	41.37	234.07*	314.81*	
10OL	B	2	10	891.61	8.6	41.38	220.31*	326.97*	
10OL	B	3	10	889.32	8.8	40.65	225.70*	325.88*	0
10OL	B	4	10	896.83	8.8	41.80	213.34*	313.28*	
10OL	B	5	10	893.24	8.6	40.99	191.09*	217.73*	
11	B	1	5	892.62	9.1	37.3	362	462	
11	B	2	5	889.98	9.0	37.0	391	492	
11	B	3	5	884.30	8.9	38.5	352	449	0
11	B	4	5	889.82	8.7	35.9	364	464	
11	B	5	5	884.52	8.6	37.1	365	463	
13	B	1	1	890.30	8.7	46.90	342.11	380.12	
13	B	2	1	898.70	8.6	47.02	356.78	396.45	
13	B	3	1	877.40	8.8	44.24	340.25	377.59	5
13	B	4	1	888.90	8.7	43.12	351.96	390.12	
13	B	5	1	896.20	8.6	46.20	340.23	379.25	
15	B	1	1	963.90	9.0	NA	356.03	406.23	
15	B	2	1	986.30	9.0	NA	316.80	359.09	
15	B	3	1	952.20	9.0	NA	328.99	378.66	0
15	B	4	1	943.00	9.0	NA	323.48	368.07	
15	B	5	1	961.30	9.0	NA	303.04	347.75	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations

CM9

Lab Code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
1	C	1	3	918.00	10.6	40.90	105.63	130.18	
1	C	2	3	917.00	11.0	42.06	113.64	137.10	
1	C	3	3	933.00	11.7	44.23	122.58	149.07	0
1	C	4	3	943.00	11.5	44.27	118.56	144.22	
1	C	5	3	928.00	11.4	42.03	123.08	146.36	
2	C	1	5	975.00	10.1	40.50	112.00	121.00	
2	C	2	5	981.00	10.2	40.90	112.00	121.00	
2	C	3	5	973.00	10.2	40.00	112.00	121.00	1
2	C	4	5	975.00	10.5	41.60	112.00	121.00	
2	C	5	5	991.00	10.6	38.90	112.00	121.00	
3	C	1	10	937.00	9.6	37.93	131.04	139.37	
3	C	2	10	940.00	9.9	38.01	135.71	143.82	
3	C	3	10	944.00	9.8	37.87	133.23	142.82	0
3	C	4	10	937.00	9.8	37.41	140.05	150.55	
3	C	5	10	932.00	9.5	37.58	132.46	141.55	
4	C	1	1	NR2	NR2	NR2	NR2	NR2	
4	C	2	1	NR2	NR2	NR2	NR2	NR2	
4	C	3	1	NR2	NR2	NR2	NR2	NR2	0
4	C	4	1	NR2	NR2	NR2	NR2	NR2	
4	C	5	1	NR2	NR2	NR2	NR2	NR2	
5	C	1	5	936.60	11.06	39.80	128.07	151.63	
5	C	2	5	949.52	10.48	39.56	126.07	148.79	
5	C	3	5	939.08	10.98	39.94	118.17	137.13	0
5	C	4	5	940.50	11.02	40.08	122.26	143.64	
5	C	5	5	939.18	10.94	39.86	133.17	157.67	
6	C	1	10	941.50	10.3	41.18	129.22	154.03	
6	C	2	10	937.00	10.6	41.50	125.85	151.23	
6	C	3	10	938.96	10.5	41.81	129.58	154.67	2
6	C	4	10	938.32	10.5	41.28	128.33	151.79	
6	C	5	10	936.63	10.4	41.02	124.16	148.19	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations

CM9

Lab Code	Sample	Replicate	Number of Cigs	Conditioned Weight	Puff Count	MS TPM	NO	NOx	Number of Repeats needed
			(cigs/replicate)	(mg/cig)	(per cig)	(mg/cig)	(ug/cig)	(ug/cig)	
7	C	1	5	950.46	10.64	39.66	121.867	147.595	
7	C	2	5	919.68	10.14	38.62	119.971	145.373	
7	C	3	5	933.12	10.58	39.46	117.161	139.628	0
7	C	4	5	939.54	10.46	39.00	117.566	141.170	
7	C	5	5	930.90	10.62	38.66	120.705	144.346	
9	C	1	2	932.20	11.3	42.75	145.41	182.17	
9	C	2	2	956.20	12.1	45.40	148.01	185.26	
9	C	3	2	944.45	11.0	47.40	164.57	201.10	0
9	C	4	2	923.10	11.0	43.30	145.43	181.99	
9	C	5	2	943.60	11.5	47.50	172.19	209.07	
10IL	C	1	10	942.03	10.9	42.14	139.00	150.80	
10IL	C	2	10	937.04	10.9	41.95	136.00	147.60	
10IL	C	3	10	942.24	11.0	43.57	139.00	151.80	0
10IL	C	4	10	941.16	10.8	42.94	139.00	151.90	
10IL	C	5	10	938.16	11.0	43.49	139.00	151.10	
10OL	C	1	10	942.03	10.9	42.14	83.25*	87.73*	
10OL	C	2	10	937.04	10.9	41.95	76.16*	89.63*	
10OL	C	3	10	942.24	11.0	43.57	80.99*	97.93*	0
10OL	C	4	10	941.16	10.8	42.94	75.39*	85.39*	
10OL	C	5	10	938.16	11.0	43.49	76.43*	94.46*	
11	C	1	5	937.78	10.7	42.6	140	190	
11	C	2	5	931.76	10.7	41.1	124	163	
11	C	3	5	933.06	10.8	41.5	125	166	0
11	C	4	5	941.72	10.9	42.5	130	174	
11	C	5	5	934.36	10.4	42.1	117	157	
13	C	1	1	930.70	10.5	49.23	180.77	201.56	
13	C	2	1	942.70	10.4	46.05	179.25	198.36	
13	C	3	1	929.30	10.3	48.79	191.23	211.25	5
13	C	4	1	942.00	10.4	49.23	183.45	204.69	
13	C	5	1	921.50	10.5	48.34	193.02	217.37	
15	C	1	1	1025.10	12.0	NA	104.86	134.52	
15	C	2	1	974.10	12.0	NA	96.19	124.80	
15	C	3	1	974.70	12.0	NA	88.34	115.44	0
15	C	4	1	959.40	12.0	NA	90.36	119.63	
15	C	5	1	1011.30	12.0	NA	102.16	130.66	

Where NR1 = not reported, optional for lab's method; NR2 =not reported, technical error
*outlying data not included in r&R calculations