Characterization of Tobacco and Tobacco Smoke

Analytical Test Report

Labstat®
Since 1976

Prepared for *Philip Morris International*

Project Code: NS299-H

Date: April 21, 2016

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2 USE OF LABSTAT'S[1] ANALYTICAL REPORTS

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> ***All Labstat reports on the results of product testing relate only to the sample(s) received and tested by Labstat at the time of testing. Labstat warrants that all sample(s) were tested in accordance with its standard test procedures and in accordance with its ISO 17025 accreditation. Except as stated herein, there is no warranty expressed or implied, statutory or otherwise, as to the results of analyses performed by Labstat. Labstat does not warrant or guarantee the fitness of the materials or products from which the samples have been drawn for any particular purpose including without limitation for consumption as cigarettes, cigars, smokeless tobacco or any other form of tobacco, tobacco-related product or tobacco containing product.***

[1] Labstat International ULC,

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3 ADMINISTRATIVE INFORMATION

3.1 QUOTATION IDENTIFICATION

Quotation Number: T5302

Date of Quotation: January 12, 2016

Recipient's Name: Cyril Jeannet

3.2 CLIENT IDENTIFICATION

Philip Morris International

Quai Jeanrenaud 56

2000 Neuchatel

Switzerland

4 SAMPLE HANDLING

4.1 CHAIN OF CUSTODY

The samples to be tested for project NS299-H were received on March 11, 2016 via DHL.

4.2 SAMPLE CHARACTERIZATION AND CODING

4.2.1 SAMPLE CHARACTERISTICS

The shipment received on March 11, 2016 consisted of one box for each of 6 products. Additional sticks were received on April 04, 2016. There was no physical damage to the boxes.

4.2.2 SAMPLE IDENTIFICATION

The following sample codes have been used to identify the products associated with the results in each of the tables that are part of this report.

Labstat Sample ID	SMP Description	Qty/Type Received	Type of Product	Type of Analysis
1680394	SMP060612	1/box	sticks	mainstream smoke
1680395	SMP060613	1/box	sticks	mainstream smoke
1680396	SMP060614	1/box	sticks	mainstream smoke
1680397	SMP060615	1/box	sticks	tobacco constituents
1680398	SMP060616	1/box	sticks	tobacco constituents
1680399	SMP060617	1/box	sticks	tobacco constituents

4.2.3 PHYSICAL MEASUREMENTS

Physical measurements were performed on the sticks and tobacco rods.

A representative test sample of 10 sticks was selected haphazardly from the client-submitted laboratory sample. The sticks from the test sample went through a physical characterization process, based on 10 observations (1 observation per stick) in which the measurements were recorded to the nearest 0.5mm. The following represents the characteristics which were recorded for this process:

- Total Stick Length (mm)
- Filter Length (mm)
- Overwrap Length (mm)
- Stick Diameter (at 9.0mm from the mouth end)
- Weight of Tobacco (g/unit)

These 10 observations were averaged and recorded to the nearest 0.1mm. The expected measurement variability is mean ± 1mm or mean ± 0.1g, depending on the parameter measured.

For the tobacco rods, the weight of tobacco per rod was measured.

For this project, the variability of the physical parameters measured was within the acceptance limits.

5 PROJECT-SPECIFIC INSTRUCTIONS

Test sticks were used in conjunction with a "tobacco heating system" by inserting the consumable (test stick) into a cigarette holder (CH). The CH was used in conjunction with a lighter bar to smoke the test sticks. Therefore, the following requirements of the ISO standard (see section 6.2.3) were either not applicable or could not be fulfilled for technical reasons:

- Air velocity control since the consumable is inserted into the CH.
- Butt length requirement since the heating of the consumable has no effect on the consumable length which remains unchanged after smoking.
- There was no ignition of the cigarette by an external lighter.

The use of the CH, in conjunction with the lighter bar for the test samples, required the reference cigarettes to be smoked on an independent run. All reference cigarettes were smoked to the ISO standard requirements for air velocity, butt length and ignition.

A client table was followed for testing/running the samples in different days.

6 EXPERIMENTAL DESIGN AND METHODS

The following is a summary of the instructions that have been received from the client in regard to the smoking and analysis of the tobacco products in this project.

6.1 PREPARATION OF LABORATORY COMPOSITE

A minimum sample size of 100g of tobacco is required for the testing of commercially available products. If this amount is not available, a smaller but adequate amount of sample is prepared for all analytical testing. Tobacco product is ground and sieved to ensure ≤4mm particle size, with analyses such as moisture, pH, nitrate, nitrite, eugenol and menthol being initiated as soon as possible following the preparation of the laboratory composite.

6.2 SAMPLE GENERATION

All tobacco products were conditioned and smoked under the smoking regimes outlined in the following sub-sections.

6.2.1 CIGARETTE BUTT MARKING

Prior to testing, reference cigarettes were marked with the standard butt length as specified in ISO 4387 (2000) *"Cigarettes -- Determination of total and nicotine-free dry particulate matter using a routine analytical smoking machine".* Test cigarettes did not require butt marking since these cigarettes were smoked to a pre-determined puff count (12 puffs for "Canadian Modified" and 6 puffs for "ISO").

6.2.2 CIGARETTE CONDITIONING AND SMOKING ENVIRONMENTS

Cigarettes were conditioned and smoked under the environmental conditions specified in ISO 3402 (1999) *"Tobacco and tobacco products – Atmosphere for conditioning and testing".* With respect to conditioning, this document states "*The conditioning atmosphere shall be as follows: temperature 22 ± 1℃; relative humidity 60 ± 3%*". Smoking requires an environment in which the temperature is 22 ± 2°C and the relative humidity 60 ± 5%.

6.2.3 MACHINE SMOKING CONDITIONS

Smoking of test and reference cigarettes were carried out on either a rotary smoking machine or a linear smoking machine. The smoking parameters and smoking machine specifications which were used are set out in the International Organization for Standardization standard ISO 3308:12, ***Routine analytical cigarette-smoking machine - Definitions and standard conditions*** with modifications as noted in the table below.

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The following table is a summary of the smoking parameters that were employed in this project.

Variable	"ISO"	"Canadian Modified"
Puff Volume (ml)	35	55
Interval (sec)	60	30
Duration (sec)	2	2
Vents[2]	"open"	"fully blocked"

Note: Test samples did not have any vent blocking applied. Vent blocking for "Canadian Modified" was only applied to the reference cigarettes.

Mainstream yields (MS) were obtained under "ISO" and "Canadian Modified" conditions (as defined above). Yields obtained using "ISO" smoking parameters are referred to as "standard" (s) and yields obtained using "Canadian Modified" smoking parameters are referred to as "non-standard" (n). Data files ending in (s) or (n) denote results obtained under the various conditions as noted in the previous sentence and in the above table.

6.3 ANALYTICAL METHODS[3]

6.3.1 SMOKE ANALYSIS

Test methods for the analysis of mainstream tobacco smoke are referenced in the table(s) below and were practiced as written unless otherwise indicated (see "Method Modifications").

OFFICIAL METHODS FOR THE COLLECTION OF EMISSION DATA ON MAINSTREAM SMOKE[4]

Item	Emission	Official Method	Method Description
1.	Ammonia	T-101	*Determination of Ammonia in Mainstream Tobacco Smoke*
2.	*(a)* Formaldehyde *(b)* Acetaldehyde *(c)* Acrolein *(d)* Crotonaldehyde	T-104	*Determination of Selected Carbonyls in Mainstream Tobacco Smoke*

[2] Health Canada 100% Vent Blocking Method
6(b)(iii) all ventilation holes must be blocked by placing over them a strip of Mylar adhesive tape, Scotch Brand product no. 600 Transparent Tape, and the tape must be cut so that it covers the circumference and is tightly secured from the end of the filter to the tipping overwrap seam, or by another method of equivalent efficiency.

[3] The most current version available at the time of testing was used for all test methods listed.

[4] Canadian Tobacco Reporting Regulations: 2000-07-19 Canada Gazette Part II, Vol. 134, No. 15 Part 3: Emissions from Designated Tobacco Products. Test method numbers refer to Health Canada methodologies which have been posted by Health Canada on the internet at site http://www.hc-sc.gc.ca/hl-vs/tobac-tabac/legislation/reg/indust/index_e.html

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Item	Emission	Official Method	Method Description
3.	*(a)* Tar *(b)* Nicotine *(c)* Carbon Monoxide	T-115	*Determination of "Tar", Nicotine and Carbon Monoxide in Mainstream Tobacco Smoke*

OTHER METHODS FOR THE COLLECTION OF EMISSION DATA ON MAINSTREAM SMOKE

Item	Emission	Labstat Method	Method Description
1.	Benzo(a)pyrene	TMS-00120	*Determination of Selected Polynuclear Aromatic Hydrocarbons in Mainstream Tobacco Smoke*
2.	*(a)* 1,3-Butadiene *(b)* Isoprene *(c)* Acrylonitrile *(d)* Benzene *(e)* Toluene	TMS-00124	*Determination of Vinyl Chloride, 1,3-Butadiene, Isoprene, Acrylonitrile, Benzene, Toluene, Styrene, and Acetamide in Mainstream Tobacco Smoke (expanded list)*
3.	*(a)* 1- aminonaphthalene *(b)* 2- aminonaphthalene *(c)* 4- aminobiphenyl	TMS-00128	*Determination of Aromatic Amines in Mainstream Tobacco Smoke (expanded list)*
4.	*(a)* *N*-nitrosonornicotine *(b)* 4-(*N*-nitrosomethylamino)-1-(3-pyridyl)-1-butanone	TMS-00135	*Determination of Tobacco Specific Nitrosamines in Mainstream Tobacco Smoke by High-Performance Liquid Chromatography-Tandem Mass Spectrometry*

6.3.2 CONSTITUENT ANALYSIS

Test methods for the analysis of processed tobacco are referenced in the table(s) below and were practiced as written unless otherwise indicated (see “Method Modifications”).

OFFICIAL METHODS FOR THE COLLECTION OF DATA ON CONSTITUENTS[5]

Item	Constituent	Official Method	Method Description
1.	Nicotine	T-301	*Determination of Alkaloids in Whole Tobacco*
2.	Ammonia	T-302	*Determination of Ammonia in Whole Tobacco*

[5] Canadian Tobacco Reporting Regulations: 2000-07-19 Canada Gazette Part II, Vol. 134, No. 15 Part 3: Emissions from Designated Tobacco Products. Test method numbers refer to Health Canada methodologies which have been posted by Health Canada on the internet at site http://www.hc-sc.gc.ca/hl-vs/tobac-tabac/legislation/reg/indust/index_e.html

Item	Constituent	Official Method	Method Description
3.	*(a)* Cadmium *(b)* Arsenic	T-306	*Determination of Ni, Pb, Cd, Cr, As, Se and Hg in Whole Tobacco*
4.	Moisture	AOAC 966.02	*Loss on Drying (Moisture) in Tobacco, Gravimetric Method*

OTHER METHODS FOR THE COLLECTION OF DATA ON CONSTITUENTS

Item	Constituent	Labstat Method	Method Description
1.	*(a)* *N*-nitrosonornicotine *(b)* 4-(*N*-nitrosomethylamino)-1 -(3-pyridyl)-1-butanone	TWT-00333	*Determination of Tobacco Specific Nitrosamines in Tobacco Products by Liquid Chromatography-Tandem Mass Spectrometry*

6.3.3 INTERNAL METHOD REFERENCES AND SYNOPSES

6.3.3.1 POLYNUCLEAR AROMATIC HYDROCARBONS (LABSTAT METHOD TMS-00120)

6.3.3.1.1 REFERENCE(S)

G. Gmeiner, G. Stehlkik, H. Tausch, Determination of Seventeen Polycyclic Aromatic Hydrocarbons in Tobacco Smoke Condensate, *J. Chromatogr.* A 767 (1997) 163-169.

TMS-00115 Labstat Test Method: Determination of "Tar", Nicotine and Carbon Monoxide in Mainstream Tobacco Smoke.

6.3.3.1.2 METHOD SYNOPSIS

Ten conditioned sticks were smoked (6 puffs per stick under ISO standard smoking conditions and 12 puffs per stick under Health Canada Intense (HCI) smoking conditions) using a standard rotary smoking machine, onto a conditioned, pre-weighed 92mm glass fiber filter disc (pad). The pad was spiked with internal standards (d12-benzo[a]pyrene, d14-dibenz[a,h]anthracene, d10-anthracene and d10-pyrene) and extracted with 50mL of methanol. The methanol extracts were filtered through a filter paper. A portion of filtered extract was cleaned up by Solid Phase Extraction (SPE) using a RapidTrace SPE Workstation and analyzed by gas chromatography-mass spectrometry for quantification. The mass detector was operated under Selected Ion Monitoring (SIM) mode. The ions of interest (i.e. molecular ions and in some cases specific fragment ions) were mass-selected and used for quantification.

6.3.3.2 VOLATILE ORGANICS (LABSTAT METHOD TMS-00124)

6.3.3.2.1 REFERENCE(S)

T-116 Health Canada Test Method: Determination of Selected Volatiles (1,3-Butadiene, Isoprene, Acrylonitrile, Benzene and Toluene) in Mainstream Smoke.

Byrd, G.D., K.W. Fowler, R.D. Hicks, M.E. Lovette and M.F. Borgerding (1990). Isotope dilution gas chromatography-mass spectrometry in the determination of benzene, toluene, styrene and acrylonitrile in mainstream cigarette smoke. *J. Chromat.* 503, 359-368.

Brunnemann, K.D., M.R. Kagan, J.E. Cox, and D. Hoffmann (1990). Analysis of 1,3-butadiene and other selected gas phase components in cigarette mainstream and sidestream smoke by gas chromatography-mass selective detection. *Carcinogenesis* 11, 1863-1868.

Brunnemann, K.D., M.R. Kagan, J.E. Cox, and D. Hoffmann (1989). Determination of benzene, toluene and 1,3-butadiene in cigarette smoke by GC-MSD. *Exp. Pathol.* 11, 108-113.

T-115 Health Canada Test Method: Determination of "Tar", Nicotine and Carbon Monoxide in Mainstream Tobacco Smoke.

6.3.3.2.2 METHOD SYNOPSIS

Ten conditioned sticks were smoked (6 puffs per stick under ISO standard smoking conditions and 12 puffs per stick under Health Canada Intense (HCI) smoking conditions) on a standard rotary smoking machine. The mainstream smoke was passed through a conditioned, pre-weighed 92mm glass fiber filter disc (pad) and then into two cryogenic traps placed in series after the pad, each containing 10mL of methanol. An aliquot of the solution from the two traps was spiked with the internal standards (d6-benzene, d8-styrene and d5-pyridine) and analyzed by gas chromatography – mass spectrometry (GC/MS) with ion trap under full scan mode.

6.3.3.3 AROMATIC AMINES (LABSTAT METHOD TMS-00128)

6.3.3.3.1 REFERENCE(S)

Pieraccini, G., F. Luceri, and G. Moneti (1992). New Gas-Chromatographic/Mass-Spectrometric Method for the Quantitative Analysis of Primary Amines in Main- and Sidestream Cigarette Smoke. I. *Rapid Communications in Mass Spectrometry. 6, 406-409.*

TMS-00115 Labstat Test Method: Determination of "Tar", Nicotine and Carbon Monoxide in Mainstream Tobacco Smoke.

6.3.3.3.2 METHOD SYNOPSIS

Ten conditioned sticks were smoked (6 puffs per stick under ISO standard smoking conditions and 12 puffs per stick under Health Canada Intense (HCI) smoking conditions) on a standard rotary smoking machine. The

mainstream total particulate matter (TPM) was collected on a conditioned, pre-weighed 92mm glass fiber filter disc (pad). The pad was quartered and extracted with 100mL of 5% hydrochloric acid solution. The extraction flask was shaken for 30 minutes on a wrist-action shaker and the contents filtered into a 500mL separatory funnel. The internal standards (d5-aniline, d9-o-toluidine, d7-o-anisidine, d7-4-aminobiphenyl, d8-benzidine) were spiked into the solution. The filtrate was washed with dichloromethane, made basic with sodium hydroxide solution and extracted with hexane. The hexane extracts were dried with sodium sulphate, derivatized with pentafluoropropionic acid anhydride (PFPA) and trimethylamine, concentrated by rotary evaporation, passed through a florisil column, and quantified using gas chromatography – mass spectrometry (GC/MS) with ion trap under full scan mode.

6.3.3.4 TOBACCO SPECIFIC NITROSAMINES (LABSTAT METHOD TMS-00135)

6.3.3.4.1 REFERENCE(S)

Wu, W.; Ashley, D. L.; Watson, C. H. Anal. Chem. 2003, 75, 4827-4832.

Wagner, K. A.; Finkel, N. H.; Fossett, J. E.; Gillman, I. G. Anal. Chem. 2005, 77, 1001-1006.

Lee, J-M.; Shin, J-W.; Oh, I-H.; Lee U-C.; Rhee M-S. 2004 CORESTA Congress Kyoto. Paper SS20; full text available on CORESTA CD-ROM Vol. 22; abstract available on the Internet at http://www.coresta.org/Past_Abstracts/Kyoto2004-SmokeTech.pdf (accessed December 29, 2006).

Chwojdak, C. A.; Self, D. A.; Wheeler, H. R. A Collaborative, Harmonized LC-MS/MS Method for the Determination of Tobacco Specific Nitrosamines (TSNA) in Tobacco and Tobacco Related Materials. 61st Tobacco Science Research Conference, Charlotte, NC. USA. September 24, 2007.

NIH Guidelines for the Laboratory Use of Chemical Carcinogens; NIH Publication 81-2385, 1981.

Wu. J.; Joza, P.; Sharifi, M.; Rickert, W. S.; Lauterbach, J. H. Anal. Chem. 2008, 80, 1341-1345.

6.3.3.4.2 METHOD SYNOPSIS

Five conditioned sticks were smoked (6 puffs per stick under ISO standard smoking conditions and 12 puffs per stick under Health Canada Intense (HCI) smoking conditions) per port on a standard 20 port linear smoking machine. The mainstream total particulate matter (TPM) was collected on a conditioned, pre-weighed 44mm glass fiber filter disc (pad). The pad was spiked with a deuterium labeled internal standard solution (containing NNN-d4, NAT-d4, NAB-d4, and NNK-d4) and then extracted with a 100mM ammonium acetate solution. The extract was then filtered and subject to LC-MS/MS analysis with positive electrospray ionization (ESI). Two mass transition pairs for each analyte can be used to assist analyte confirmation and quantification. The most intense pairs are used for quantification while the less intense transition pairs are used as qualifiers for further compound confirmation.

6.3.3.5 CONSTITUENT TOBACCO SPECIFIC NITROSAMINES (LABSTAT METHOD TWT-00333)

6.3.3.5.1 REFERENCE(S)

Wu, W.; Ashley, D. L.; Watson, C. H. *Anal. Chem*. **2003**, *75*, 4827-4832.

Wagner, K. A.; Finkel, N. H.; Fossett, J. E.; Gillman, I. G. *Anal. Chem.* **2005**, *77*, 1001-1006.

Lee, J-M.; Shin, J-W.; Oh, I-H.; Lee U-C.; Rhee M-S. **2004** CORESTA Congress Kyoto. Paper SS20; full text available on CORESTA CD-ROM Vol. 22; abstract available on the Internet at http://www.coresta.org/Past_Abstracts/Kyoto2004-SmokeTech.pdf (accessed December 29, **2006**).

Chwojdak, C. A.; Self, D. A.; Wheeler, H. R. *A Collaborative, Harmonized LC-MS/MS Method for the Determination of Tobacco Specific Nitrosamines (TSNA) in Tobacco and Tobacco Related Materials.* 61st Tobacco Science Research Conference, Charlotte, NC. USA. September 24, **2007**.

NIH Guidelines for the Laboratory Use of Chemical Carcinogens; NIH Publication 81-2385, **1981**.

Wu. J.; Joza, P.; Sharifi, M.; Rickert, W. S.; Lauterbach, J. H. Anal. Chem. **2008**, 80, 1341-1345.

Nicotine and Total Reducing Sugars", Technicon Industrial Systems Corp., 1025 Busch Parkway, Buffalo Grove, Illinois, USA 60090 - 4516

6.3.3.5.2 METHOD SYNOPSIS

Two (2) grams of tobacco product was ground using a bench-top grinder and a #40 screen (40 sections / square inch). Seven hundred fifty milligrams of ground tobacco product was spiked with the internal standards solution (d4-NNN and d4-NNK) and extracted with 30mL of an aqueous ammonium acetate solution on a wrist action shaker for 30 minutes. The extract was then filtered and subject to LC-MS/MS analysis with positive electrospray ionization (ESI). Two mass transition pairs for each analyte can be used to assist analyte confirmation and quantification. The most intense pairs are used for quantification while the less intense transition pairs are used as qualifiers for further compound confirmation.

6.4 METHOD MODIFICATIONS

6.4.1 CONSTITUENT METALS (HEALTH CANADA METHOD T-306)

Samples were digested using 0.5g of ground, freeze-dried sample, 4mL of nitric acid (Ultrapure Fisher Optima chemical grade) and 2mL of Type I water. An Ultrawave digestion system was used for the digestion of the samples. This digestion system is a pressure vessel with microwave heating where samples are digested at 230°C and 40bar pressure.

7 ACCEPTANCE OF DATA

7.1 EVALUATION OF RESULTS FROM CONTROL MATERIALS

Data obtained using control materials are deemed acceptable if the data are in keeping with Labstat's database for the control material and the specific method of analysis[6]. This is not a simple problem since there is no "yes" or "no" answer but rather one which is phrased in terms of probabilities. In the approach taken by Labstat, the measure of random variation in the procedure is taken to be the sample standard deviation (S.D. or "s").

To evaluate control data accuracy, a "*Z score*" statistic is determined as follows:

$$Z\text{ - }score = \frac{\text{Sample Average - Historical Average}}{\text{Historical Standard Deviation}}$$

To evaluate control data precision, a "*Chi-square*" statistic is determined as follows:

$$Chi\text{ - }square = (\text{Sample Size - 1}) \times \frac{(\text{Sample Standard Deviation})^2}{(\text{Historical Standard Deviation})^2}$$

P values are generated and the cut-off point (α) chosen in such a way as to minimize the chance of rejecting data which are legitimate members of the set (i.e. type 1 error). Thus, in most cases where the number of observed control samples is greater than or equal to 5, z-score p-values are generated from the Standard Normal distribution.

The standard deviation rather than the standard error for the mean has been chosen when determining the 'Z score'. This allows for both project-to-project variation, which is inherent in the historical data, and the 'normal' run-to-run variability, which is present in the data set. The cut-off point for P values is a matter of judgment and has been set at 0.005 assuming the probability of falsely rejecting a data point is 0.5% (i.e. α=0.01) or less for a two tailed test.

In instances where expected values are not known, a decision to accept the data is made based on observed levels of precision in comparison with that determined for similar analyses. Also, there are circumstances where the expected value may be "Below Detection Limits". In this case the decision to accept or reject the data is made upon the ability of the method to recover the analyte of interest either in the form of a laboratory fortified blank (LFB) or laboratory fortified matrix (LFM). Acceptable recoveries are close to 100%, but vary depending on the analyte.

[6] A minimum of 30 results is normally required for the purpose of this comparison.

7.2 IDENTIFICATION OF OUTLIERS[7]

7.2.1 OUTLIER DEFINITION

An outlying observation, or "outlier," is one that appears to deviate markedly from other members of the sample in which it occurs. In this case, there are two alternatives:

1. An outlying observation may be merely an extreme manifestation of the random variability inherent in the data. If this is true, the value is retained and processed in the same manner as the other observations in the sample.
2. The observation may be the result of gross deviation from prescribed experimental procedure or an error in calculating or recording the numerical value. In such cases, an investigation must be carried out. When the experimenter is clearly aware that a gross deviation from prescribed experimental procedure has taken place, the resultant observation is discarded (assignable cause) without recourse to a statistical test. A statistical test may always be used to support a judgment that a physical reason does actually exist for an outlier, or the statistical criterion may be used routinely as a basis to initiate action to find a physical cause.

7.2.2 STATISTICAL CRITERIA

There are a number of criteria for testing outliers. In all of these, the doubtful observation is included in the calculation of the numerical value of a sample criterion (or statistic) that is then compared with a critical value. The critical value is that which would be exceeded by chance with some specified (small) probability on the assumption that all the observations did indeed constitute a random sample from a single parent population, distribution or universe. The specified small probability is called the "significance level" and can be thought of as the risk of erroneously rejecting a good observation. A level of significance of 0.02 has been chosen in conjunction with the statistical test and tables described in ASTM E178-08[8].

Significant departures from the expected results (i.e. “outliers”) are viewed seriously, requiring an investigation for an assignable cause. This is a documented procedure that, at a minimum, consists of the following steps:

1. Review of all associated calculations to ensure that arithmetic errors have not been made
2. Review of linearity range for any standards
3. Assessment of instrument status
4. Review of reagents, columns, standards etc. to ensure that contamination or decomposition has not occurred
5. Review of sample preparation and handling procedures as they relate to the result in question

[7] The term "outlier" has been defined in International Standard ISO 3534-1:2006 entitled "*Statistics - Vocabulary and symbols - Part 1: General statistical terms and terms used in probability*"

[8] ASTM Designation: E178-08. Standard Practice for Dealing with Outlying Observations

If the outlier is present in the analyte data and an assignable cause is found, the test result is removed from the data set but recorded in the quality control section of the laboratory's record of test results for that project. The analysis must then be repeated. If the outlier is present in the ancillary[9] data and an assignable cause is found, the test result is not removed, but rather the outlying observation is replaced by the designation "AC" (Assignable Cause). If this investigation fails to determine an assignable cause, the test result is assumed to be a legitimate member of the data set and is included in all subsequent calculations.

8 RESULTS

8.1 QUALITY CONTROL

The control results for the variables of interest were acceptable as defined in section 7.1. Consequently it is reasonable to assume that the values determined for the test samples are reflective of the characteristics of the products as received and tested as described in the Analytical Methods section.

8.2 ANALYTICAL DATA

Individual results and the corresponding sample statistics (consisting of means, standard deviations, and coefficients of variation or 95% confidence limits) may be found in the data files, labeled *NS299-H_ms_dataCF.xls, NS299-H_ms_controlsCF.xls, NS299-H_wt_dataCF.xls,* and *NS299-H_wt_controlsCF.xls*, which accompany this report.

8.2.1 SAMPLE STATISTIC CALCULATIONS

In cases where a sample result is below the limit of detection (LOD), the average of the value zero (0) and the LOD is used in the sample statistic calculation. In cases where a sample result is between the LOD and the limit of quantification (LOQ), the average of the LOD and the LOQ is used in the sample statistic calculation.

[9] Data, which are related, but not normally required as part of the reporting process (e.g. puff counts, TPM, cigarette weights etc.). Outliers in the analyte data that have an assignable cause are always repeated.

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9 ACCREDITATION

Labstat International ULC has been accredited by the Standards Council of Canada to International Standard ISO/IEC 17025:2005 "*General requirements for the competence of testing and calibration laboratories*" with a scope[10] that includes all of the mandated tobacco-related Health Canada methods (see Tobacco Reporting Regulations dated 26 June 2000, Canada Gazette Part II, Vol. 134, No. 15 Schedules 1, 2 and 3 pages 1780 – 1785). The testing included in this report is within the scope of this accreditation, unless otherwise noted.

Accredited LAB 368
(SCC Accreditation & Design Mark is an Official Mark of the Standards Council of Canada, used under license)

10 AUTHORIZATION

This report has been reviewed by me and is certified, to the best of my knowledge, to be a true and accurate description of the procedures, protocols and test methods used to arrive at the data and/or findings that accompany this report.

Dated: April 21, 2016

Peter Joza,

Director, Science & Technology

Labstat International ULC

[10] Labstat's accreditation scope is available on Standards Council of Canada website at: http://palcan.scc.ca/specs/pdf/180_e.pdf

11 APPENDIX A: "RAW" DATA AND SUMMARY STATISTICS: MAINSTREAM SMOKE

Labstat Sample ID	SMP Description	Qty/Type Received	Type of Product	Type of Analysis
1680394	SMP060612	1/box	sticks	mainstream smoke
1680395	SMP060613	1/box	sticks	mainstream smoke
1680396	SMP060614	1/box	sticks	mainstream smoke

Limits of Detection (LOD) and Limits of Quantification (LOQ) Determined for Selected Mainstream Constituents of Tobacco Smoke

Health Canada Method	Analyte	Units	Mainstream ('ISO')		Mainstream ('Intense')	
			LOD	LOQ	LOD	LOQ
	Ammonia					
T-101	Ammonia	µg/cig	0.184	0.613	0.184	0.613
	Selected Carbonyls					
T-104	Formaldehyde	µg/cig	0.361	1.20	0.361	1.20
T-104	Acetaldehyde	µg/cig	0.973	3.24	0.973	3.24
T-104	Acrolein	µg/cig	0.713	2.38	0.713	2.38
T-104	Crotonaldehyde	µg/cig	0.988	3.29	0.988	3.29
	Tar, Nicotine, and Carbon Monoxide					
T-115	Tar	mg/cig	0.071	0.237	0.071	0.237
T-115	Nicotine	mg/cig	0.001	0.004	0.001	0.004
T-115	CO	mg/cig	0.067	0.223	0.067	0.223
T-115	Water	mg/cig	0.038	0.128	0.038	0.128
T-115	TPM	mg/cig	0.060	0.200	0.060	0.200

Abbreviations: BDL, below detection limit; NQ, below quantitation limit; N/A, not applicable
Date of last review: May 30, 2012

For further information regarding the terms 'ISO' and 'Intense' ('Modified'), please refer to Health Canada's website at: http://www.hc-sc.gc.ca/hl-vs/tobac-tabac/legislation/reg/indust/constitu_e.html

LOD Definition: The limit of detection (LOD) for a particular analyte is a statistically defined decision point that, with a specified probability, measured results falling at or above this point are interpreted to indicate an analyteconcentration greater than zero within the sample.

LOQ Definition: The limit of quantification for a particular analyte is another statistically defined decision point that results falling at or above this point can be assigned a statistically significant numerical value with an associated level of precision. Values falling between the LOD and LOQ are interpreted as a positive but not quantifiable result for the analyte in question.

Limits of Detection (LOD) and Limits of Quantification (LOQ) Determined for Selected PAH Mainstream Constituents of Tobacco Smoke

Labstat Method	Analyte	Units	Mainstream ('ISO')		Mainstream ('Intense')	
			LOD	LOQ	LOD	LOQ
PAH						
TMS-00120	Benzo(a)pyrene	ng/cig	0.106	0.354	0.106	0.354

Abbreviations: BDL, below detection limit; NQ, below quantitation limit; N/A, not applicable
Date of last review: May 30, 2012

For further information regarding the terms 'ISO' and 'Intense' ('Modified'), please refer to Health Canada's website at: http://www.hc-sc.gc.ca/hl-vs/tobac-tabac/legislation/reg/indust/constitu_e.html

LOD Definition: The limit of detection (LOD) for a particular analyte is a statistically defined decision point that, with a specified probability, measured results falling at or above this point are interpreted to indicate an analyte concentration greater than zero within the sample.

LOQ Definition: The limit of quanitification for a particular analyte is another statistically defined decision point that results falling at or above this point can be assigned a statistically significant numerical value with an associated level of precision. Values falling between the LOD and LOQ are intrepreted as a positive but not quantifiable result for the analyte in question.

Limits of Detection (LOD) and Limits of Quantification (LOQ) Determined for Selected Mainstream Constituents of Tobacco Smoke

Labstat Method	Analyte	Units	Mainstream ('ISO')		Mainstream ('Intense')	
			LOD	LOQ	LOD	LOQ
	Volatiles (Gas Phase)					
TMS-00124	1,3-butadiene	µg/cig	0.029	0.095	0.029	0.095
TMS-00124	Isoprene	µg/cig	0.041	0.135	0.041	0.135
TMS-00124	Acrylonitrile	µg/cig	0.032	0.107	0.032	0.107
TMS-00124	Benzene	µg/cig	0.017	0.056	0.017	0.056
TMS-00124	Toluene	µg/cig	0.061	0.204	0.061	0.204
	Aromatic Amines (HPHC)					
TMS-00128	1-aminonaphthalene	ng/cig	0.008	0.027	0.008	0.027
TMS-00128	2-aminonaphthalene	ng/cig	0.004	0.012	0.004	0.012
TMS-00128	4-aminobiphenyl	ng/cig	0.001	0.005	0.001	0.005

Abbreviations: BDL, below detection limit; NQ, below quantitation limit; N/A, not applicable
Date of last review: May 30, 2012

For further information regarding the terms 'ISO' and 'Intense' ('Modified'), please refer to Health Canada's website at: http://www.hc-sc.gc.ca/hl-vs/tobac-tabac/legislation/reg/indust/constitu_e.html

LOD Definition: The limit of detection (LOD) for a particular analyte is a statistically defined decision point that, with a specified probability, measured results falling at or above this point are interpreted to indicate an analyte concentration greater than zero within the sample.

LOQ Definition: The limit of quantification for a particular analyte is another statistically defined decision point that results falling at or above this point can be assigned a statistically significant numerical value with an associated level of precision. Values falling between the LOD and LOQ are interpreted as a positive but not quantifiable result for the analyte in question.

Limits of Detection (LOD) and Limits of Quantification (LOQ) Determined for Selected Mainstream Constituents of Tobacco Smoke

Labstat Method	Analyte	Units	Mainstream ('ISO')		Mainstream ('Intense')	
			LOD	LOQ	LOD	LOQ
	Tobacco Specific Nitrosamines (LC-MS/MS)					
TMS-00135	Nitrosonornicotine (NNN)	ng/cig	0.098	0.328	0.197	0.656
TMS-00135	4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	ng/cig	0.151	0.502	0.301	1.00

Abbreviations: BDL, below detection limit; NQ, below quantitation limit; N/A, not applicable
Date of last review: May 01, 2013

For further information regarding the terms 'ISO' and 'Intense' ('Modified'), please refer to Health Canada's website at: http://www.hc-sc.gc.ca/hl-vs/tobac-tabac/legislation/reg/indust/constitu_e.html

LOD Definition: The limit of detection (LOD) for a particular analyte is a statistically defined decision point that, with a specified probability, measured results falling at or above this point are interpreted to indicate an analyte concentration greater than zero within the sample.

LOQ Definition: The limit of quantification for a particular analyte is another statistically defined decision point that results falling at or above this point can be assigned a statistically significant numerical value with an associated level of precision. Values falling between the LOD and LOQ are interpreted as a positive but not quantifiable result for the analyte in question.

* Methods have been modified from the standard methods.

Weight of Tobacco in Bidi, Cigarette, Cigar, Tobacco Stick or Kretek Samples (milligrams of tobacco per unit 'as received')*

	Sample ID		
Obs.	1680394	1680395	1680396
1	292.8	295.0	300.3
2	299.7	290.5	304.8
3	316.7	296.6	311.9
4	286.7	292.0	308.7
5	315.7	286.5	296.9
6	286.1	291.6	300.4
7	284.9	291.8	299.2
8	298.5	297.3	296.5
9	285.0	272.5	301.5
10	300.0	279.6	288.5
Average	296.6	289.3	300.9
Std. Dev	12.0	7.8	6.6
L. Limit (95%)	288.1	283.7	296.2
U. Limit (95%)	305.2	295.0	305.6

Weight of Tobacco in Bidi, Cigarette, Cigar, Tobacco Stick or Kretek Samples (milligrams of tobacco per unit 'dry weight')**

Sample ID	Tobacco Weight (mg/unit)	Dry Matter (%)	Tobacco Weight (mg/unit) 'dry weight'
1680394	296.6	n/a	n/a
1680395	289.3	n/a	n/a
1680396	300.9	n/a	n/a

* as required in part 3, section 14 (2)c of the Canadian Tobacco Reporting Regulations

** as required in part 2, section 12 (6) and 12 (7)ci. of the Canadian Tobacco Reporting Regulations

n/a: not applicable

Smoke Constituent	Matrix Code / Sample ID / Condition / Unit	MS 1680394 S Average	MS 1680394 S Std. Dev.	MS 1680394 S L. Limit (95%)	MS 1680394 S U. Limit (95%)	MS 1680394 N Average	MS 1680394 N Std. Dev.	MS 1680394 N L. Limit (95%)	MS 1680394 N U. Limit (95%)
Ammonia									
Ammonia	[µg/cig]	1.47	0.30	1.19	1.74	12.5	1.6	11.0	14.0
Selected Carbonyls									
Formaldehyde	[µg/cig]	11.9	0.3	11.6	12.2	14.4	0.4	14.0	14.8
Acetaldehyde	[µg/cig]	125	5	120	129	186	5	181	191
Acrolein	[µg/cig]	4.06	0.53	3.57	4.55	9.16	0.62	8.58	9.74
Crotonaldehyde	[µg/cig]	NQ	NQ	N/A	N/A	NQ	NQ	N/A	N/A
Tar, Nicotine, and Carbon Monoxide									
Tar	[mg/cig]	11.4	1.0	10.9	11.8	25.8	2.7	24.5	27.0
Nicotine	[mg/cig]	0.393	0.034	0.377	0.409	1.07	0.05	1.05	1.09
CO	[mg/cig]	NQ	NQ	N/A	N/A	0.338	0.035	0.322	0.354
PAH									
Benzo(a)pyrene	[ng/cig]	NQ	NQ	N/A	N/A	0.512	0.038	0.477	0.547
Volatiles (Gas Phase)									
1,3-butadiene	[µg/cig]	0.121	0.005	0.117	0.125	0.230	0.028	0.203	0.256
Isoprene	[µg/cig]	1.06	0.12	0.950	1.18	1.69	0.24	1.47	1.90
Acrylonitrile	[µg/cig]	NQ	NQ	N/A	N/A	0.121	0.025	0.097	0.144
Benzene	[µg/cig]	0.294	0.104	0.198	0.390	0.509	0.075	0.439	0.578
Toluene	[µg/cig]	0.921	0.318	0.628	1.22	1.38	0.23	1.17	1.60
Aromatic Amines (HPHC)									
1-aminonaphthalene	[ng/cig]	0.034	0.019	0.016	0.051	0.040	0.013	0.028	0.052
2-aminonaphthalene	[ng/cig]	0.022	0.016	0.007	0.038	0.025	0.006	0.019	0.031
4-aminobiphenyl	[ng/cig]	0.006	0.003	0.003	0.008	0.010	0.002	0.008	0.011
Tobacco Specific Nitrosamines (LC-MS/MS)									
Nitrosonornicotine (NNN)	[ng/cig]	3.19	0.63	2.60	3.78	7.95	0.37	7.61	8.30
4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	[ng/cig]	2.83	0.41	2.46	3.21	6.51	0.57	5.99	7.04

Glossary of Abbreviations

Condition:

S: puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, none.

N: puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%.

NQ: Below the Limit of Quantification

N/A: Not Applicable

L. Limit (95%): lower limit of the 95% confidence interval

U. Limit (95%): upper limit of the 95% confidence interval

Smoke Constituent	Matrix Code / Sample ID / Condition / Unit	MS 1680395 S Average	MS 1680395 S Std. Dev.	MS 1680395 S L. Limit (95%)	MS 1680395 S U. Limit (95%)	MS 1680395 N Average	MS 1680395 N Std. Dev.	MS 1680395 N L. Limit (95%)	MS 1680395 N U. Limit (95%)
Ammonia									
Ammonia	[µg/cig]	1.40	0.23	1.19	1.62	11.8	1.0	10.9	12.8
Selected Carbonyls									
Formaldehyde	[µg/cig]	12.1	0.4	11.8	12.4	15.4	1.4	14.1	16.7
Acetaldehyde	[µg/cig]	129	6	123	134	199	12	188	210
Acrolein	[µg/cig]	3.93	0.42	3.54	4.32	9.49	1.25	8.34	10.6
Crotonaldehyde	[µg/cig]	NQ	NQ	N/A	N/A	NQ	NQ	N/A	N/A
Tar, Nicotine, and Carbon Monoxide									
Tar	[mg/cig]	11.1	1.0	10.6	11.5	25.2	2.7	24.0	26.5
Nicotine	[mg/cig]	0.392	0.031	0.378	0.407	1.14	0.06	1.11	1.16
CO	[mg/cig]	NQ	NQ	N/A	N/A	0.331	0.041	0.311	0.350
PAH									
Benzo(a)pyrene	[ng/cig]	NQ	NQ	N/A	N/A	0.585	0.044	0.544	0.626
Volatiles (Gas Phase)									
1,3-butadiene	[µg/cig]	0.115	0.013	0.103	0.127	0.218	0.024	0.195	0.240
Isoprene	[µg/cig]	0.997	0.181	0.830	1.16	1.50	0.22	1.30	1.71
Acrylonitrile	[µg/cig]	NQ	NQ	N/A	N/A	0.128	0.029	0.101	0.154
Benzene	[µg/cig]	0.287	0.124	0.172	0.401	0.476	0.050	0.430	0.521
Toluene	[µg/cig]	0.845	0.322	0.547	1.14	1.31	0.13	1.19	1.44
Aromatic Amines (HPHC)									
1-aminonaphthalene	[ng/cig]	0.028	0.017	0.012	0.044	0.036	0.009	0.027	0.045
2-aminonaphthalene	[ng/cig]	0.021	0.019	0.004	0.038	0.017	0.006	0.011	0.023
4-aminobiphenyl	[ng/cig]	0.006	0.002	0.004	0.009	0.009	0.002	0.007	0.011
Tobacco Specific Nitrosamines (LC-MS/MS)									
Nitrosonornicotine (NNN)	[ng/cig]	3.45	0.34	3.14	3.76	8.87	0.53	8.38	9.36
4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	[ng/cig]	3.08	0.29	2.81	3.35	7.66	0.48	7.21	8.10

Glossary of Abbreviations

Condition:

S: puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, none.

N: puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%.

NQ: Below the Limit of Quantification

N/A: Not Applicable

L. Limit (95%): lower limit of the 95% confidence interval

U. Limit (95%): upper limit of the 95% confidence interval

Smoke Constituent	Matrix Code / Sample ID / Condition / Unit	MS 1680396 S Average	MS 1680396 S Std. Dev.	MS 1680396 S L. Limit (95%)	MS 1680396 S U. Limit (95%)	MS 1680396 N Average	MS 1680396 N Std. Dev.	MS 1680396 N L. Limit (95%)	MS 1680396 N U. Limit (95%)
Ammonia									
Ammonia	[µg/cig]	1.23	0.09	1.14	1.32	11.0	0.8	10.2	11.7
Selected Carbonyls									
Formaldehyde	[µg/cig]	12.0	0.2	11.8	12.2	14.8	0.6	14.3	15.4
Acetaldehyde	[µg/cig]	126	4	122	130	199	7	193	205
Acrolein	[µg/cig]	3.92	0.20	3.73	4.11	9.31	0.68	8.68	9.93
Crotonaldehyde	[µg/cig]	NQ	NQ	N/A	N/A	NQ	NQ	N/A	N/A
Tar, Nicotine, and Carbon Monoxide									
Tar	[mg/cig]	11.1	1.1	10.5	11.6	25.6	2.4	24.5	26.7
Nicotine	[mg/cig]	0.381	0.031	0.367	0.396	1.10	0.05	1.07	1.12
CO	[mg/cig]	NQ	NQ	N/A	N/A	0.324	0.008	0.320	0.328
PAH									
Benzo(a)pyrene	[ng/cig]	NQ	NQ	N/A	N/A	0.521	0.059	0.467	0.576
Volatiles (Gas Phase)									
1,3-butadiene	[µg/cig]	0.110	0.010	0.101	0.119	0.237	0.030	0.210	0.265
Isoprene	[µg/cig]	0.929	0.061	0.872	0.985	1.68	0.22	1.48	1.88
Acrylonitrile	[µg/cig]	NQ	NQ	N/A	N/A	0.139	0.025	0.117	0.162
Benzene	[µg/cig]	0.230	0.053	0.181	0.279	0.518	0.069	0.455	0.582
Toluene	[µg/cig]	0.658	0.219	0.455	0.861	1.55	0.29	1.29	1.82
Aromatic Amines (HPHC)									
1-aminonaphthalene	[ng/cig]	NQ	NQ	N/A	N/A	0.036	0.006	0.030	0.042
2-aminonaphthalene	[ng/cig]	NQ	NQ	N/A	N/A	0.017	0.007	0.010	0.023
4-aminobiphenyl	[ng/cig]	0.005	0.001	0.004	0.006	0.008	0.002	0.006	0.009
Tobacco Specific Nitrosamines (LC-MS/MS)									
Nitrosonornicotine (NNN)	[ng/cig]	3.27	0.24	3.04	3.49	7.77	0.71	7.12	8.42
4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	[ng/cig]	2.88	0.27	2.63	3.12	6.34	0.51	5.86	6.81

Glossary of Abbreviations

Condition:

S: puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, none.

N: puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%.

NQ: Below the Limit of Quantification

N/A: Not Applicable

L. Limit (95%): lower limit of the 95% confidence interval

U. Limit (95%): upper limit of the 95% confidence interval

AEROSOL (ISO REGIMEN) REPORT WORKSHEET (1680394)

HPHC Name	CAS Code	FDA UNII Code	Smoking Machine	Number of Cigarettes per Smoke Trap	Number of Smoke Traps per Replicate	Number of Replicate Measurements	Test Start Date	Test End Date
Acetaldehyde	75-07-0	GO1N1ZPR3B	Linear	2	1	7	12/04/2016	19/04/2016
Acrolein	107-02-8	7864XYD3JJ	Linear	2	1	7	12/04/2016	19/04/2016
Acrylonitrile	107-13-1	MP1U0D42PE	Linear	10	1	7	01/04/2016	04/04/2016
4-Aminobiphenyl	92-67-1	16054949HJ	Linear	10	1	7	07/04/2016	11/04/2016
1-Aminonaphthalene	134-32-7	9753I242R5	Linear	10	1	7	07/04/2016	11/04/2016
2-Aminonaphthalene	91-59-8	CKR7XL41N4	Linear	10	1	7	07/04/2016	11/04/2016
Ammonia	7664-41-7	5138Q19F1X	Linear	5	1	7	05/04/2016	07/04/2016
Benzene	71-43-2	J64922108F	Linear	10	1	7	01/04/2016	04/04/2016
Benzo[a]pyrene	50-32-8	3417WMA06D	Linear	5	1	7	02/04/2016	08/04/2016
1,3-Butadiene	106-99-0	JSD5FGP5VD	Linear	10	1	7	01/04/2016	04/04/2016
Carbon monoxide	630-08-0	7U1EE4V452	Linear	5	1	20	30/03/2016	31/03/2016
Crotonaldehyde	4170-30-3	9G72074TUW	Linear	2	1	7	12/04/2016	19/04/2016
Formaldehyde	50-00-0	1HG84L3525	Linear	2	1	7	12/04/2016	19/04/2016
Isoprene	78-79-5	0A62964IBU	Linear	10	1	7	01/04/2016	04/04/2016
Nicotine (total)	54-11-5	6M3C89ZY6R	Linear	5	1	20	30/03/2016	31/03/2016
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	7S395EDO61	Linear	5	1	7	06/04/2016	11/04/2016
N-nitrosonornicotine (NNN)	16543-55-8	X656TZ86DX	Linear	5	1	7	06/04/2016	11/04/2016
Toluene	108-88-3	3FPU23BG52	Linear	10	1	7	01/04/2016	04/04/2016

HPHC Name	Method of Extraction	Method of Separation	If "Other" Method of Separation, Specify	Method of Detection	If "Other" Method of Detection, Specify
Acetaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrolein	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrylonitrile	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
4-Aminobiphenyl	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
1-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
2-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
Ammonia	Health Canada Method T-101; Extract with 0.05N H2SO4, 30 min.	IC	Not Applicable	Other	CD: Conductivity detection
Benzene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Benzo[a]pyrene	NS235_Report.pdf Section 6.3.3.1; methanol, shake 30 min + sonicate 15 min.	GC	Not Applicable	MSD	Not Applicable
1,3-Butadiene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Carbon monoxide	Health Canada Method T-115 (ISO 4387, 8454); direct vapour phase collection	Not Applicable	Not Applicable	NDIR	Not Applicable
Crotonaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Formaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Isoprene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Nicotine (total)	Health Canada Method T-115 (ISO 4387, 10315); isopropanol, 45 min.	GC	Not Applicable	FID	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
N-nitrosonornicotine (NNN)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
Toluene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable

HPHC Name	Mean Quantity of HPHC per Cigarette	Variance of Mean HPHC Quantity	Type of Variance	Unit of Measurement - Mean & Variance	If "Other" Unit of Measurement Mean & Variance, Specify
Acetaldehyde	124.518	5.385	standard deviation	µg/cig	Not Applicable
Acrolein	4.060	0.526	standard deviation	µg/cig	Not Applicable
Acrylonitrile	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
4-Aminobiphenyl	0.006	0.003	standard deviation	ng/cig	Not Applicable
1-Aminonaphthalene	0.034	0.019	standard deviation	ng/cig	Not Applicable
2-Aminonaphthalene	0.022	0.016	standard deviation	ng/cig	Not Applicable
Ammonia	1.467	0.295	standard deviation	µg/cig	Not Applicable
Benzene	0.294	0.104	standard deviation	µg/cig	Not Applicable
Benzo[a]pyrene	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
1,3-Butadiene	0.121	0.005	standard deviation	µg/cig	Not Applicable
Carbon monoxide	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Crotonaldehyde	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Formaldehyde	11.912	0.308	standard deviation	µg/cig	Not Applicable
Isoprene	1.063	0.122	standard deviation	µg/cig	Not Applicable
Nicotine (total)	0.393	0.034	standard deviation	mg/cig	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	2.833	0.406	standard deviation	ng/cig	Not Applicable
N-nitrosonornicotine (NNN)	3.190	0.633	standard deviation	ng/cig	Not Applicable
Toluene	0.921	0.318	standard deviation	µg/cig	Not Applicable

AEROSOL REPORT (INTENSE REGIMEN) WORKSHEET (1680394)

HPHC Name	CAS Code	FDA UNII Code	Smoking Machine	Number of Cigarettes per Smoke Trap	Number of Smoke Traps per Replicate	Number of Replicate Measurements	Test Start Date	Test End Date
Acetaldehyde	75-07-0	GO1N1ZPR3B	Linear	2	1	7	17/04/2016	20/04/2016
Acrolein	107-02-8	7864XYD3JJ	Linear	2	1	7	17/04/2016	20/04/2016
Acrylonitrile	107-13-1	MP1U0D42PE	Linear	10	1	7	31/03/2016	04/04/2016
4-Aminobiphenyl	92-67-1	16054949HJ	Linear	10	1	7	31/03/2016	05/04/2016
1-Aminonaphthalene	134-32-7	9753I242R5	Linear	10	1	7	31/03/2016	05/04/2016
2-Aminonaphthalene	91-59-8	CKR7XL41N4	Linear	10	1	7	31/03/2016	05/04/2016
Ammonia	7664-41-7	5138Q19F1X	Linear	5	1	7	04/04/2016	06/04/2016
Benzene	71-43-2	J64922108F	Linear	10	1	7	31/03/2016	04/04/2016
Benzo[a]pyrene	50-32-8	3417WMA06D	Linear	5	1	7	30/03/2016	09/04/2016
1,3-Butadiene	106-99-0	JSD5FGP5VD	Linear	10	1	7	31/03/2016	04/04/2016
Carbon monoxide	630-08-0	7U1EE4V452	Linear	5	1	20	07/04/2016	11/04/2016
Crotonaldehyde	4170-30-3	9G72074TUW	Linear	2	1	7	17/04/2016	20/04/2016
Formaldehyde	50-00-0	1HG84L3525	Linear	2	1	7	17/04/2016	20/04/2016
Isoprene	78-79-5	0A62964IBU	Linear	10	1	7	31/03/2016	04/04/2016
Nicotine (total)	54-11-5	6M3C89ZY6R	Linear	5	1	20	07/04/2016	11/04/2016
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	7S395EDO61	Linear	5	1	7	11/04/2016	12/04/2016
N-nitrosonornicotine (NNN)	16543-55-8	X656TZ86DX	Linear	5	1	7	11/04/2016	12/04/2016
Toluene	108-88-3	3FPU23BG52	Linear	10	1	7	31/03/2016	04/04/2016

HPHC Name	Method of Extraction	Method of Separation	If "Other" Method of Separation, Specify	Method of Detection	If "Other" Method of Detection, Specify
Acetaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrolein	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrylonitrile	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
4-Aminobiphenyl	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
1-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
2-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
Ammonia	Health Canada Method T-101; Extract with 0.05N H2SO4, 30 min.	IC	Not Applicable	Other	CD: Conductivity detection
Benzene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Benzo[a]pyrene	NS235_Report.pdf Section 6.3.3.1; methanol, shake 30 min + sonicate 15 min.	GC	Not Applicable	MSD	Not Applicable
1,3-Butadiene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Carbon monoxide	Health Canada Method T-115 (ISO 4387, 8454); direct vapour phase collection	Not Applicable	Not Applicable	NDIR	Not Applicable
Crotonaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Formaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Isoprene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Nicotine (total)	Health Canada Method T-115 (ISO 4387, 10315); isopropanol, 45 min.	GC	Not Applicable	FID	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
N-nitrosonornicotine (NNN)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
Toluene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable

HPHC Name	Mean Quantity of HPHC per Cigarette	Variance of Mean HPHC Quantity	Type of Variance	Unit of Measurement - Mean & Variance	If "Other" Unit of Measurement Mean & Variance, Specify
Acetaldehyde	186.379	5.371	standard deviation	µg/cig	Not Applicable
Acrolein	9.161	0.623	standard deviation	µg/cig	Not Applicable
Acrylonitrile	0.121	0.025	standard deviation	µg/cig	Not Applicable
4-Aminobiphenyl	0.010	0.002	standard deviation	ng/cig	Not Applicable
1-Aminonaphthalene	0.040	0.013	standard deviation	ng/cig	Not Applicable
2-Aminonaphthalene	0.025	0.006	standard deviation	ng/cig	Not Applicable
Ammonia	12.494	1.604	standard deviation	µg/cig	Not Applicable
Benzene	0.509	0.075	standard deviation	µg/cig	Not Applicable
Benzo[a]pyrene	0.512	0.038	standard deviation	ng/cig	Not Applicable
1,3-Butadiene	0.230	0.028	standard deviation	µg/cig	Not Applicable
Carbon monoxide	0.338	0.035	standard deviation	mg/cig	Not Applicable
Crotonaldehyde	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Formaldehyde	14.439	0.438	standard deviation	µg/cig	Not Applicable
Isoprene	1.686	0.236	standard deviation	µg/cig	Not Applicable
Nicotine (total)	1.072	0.048	standard deviation	mg/cig	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	6.514	0.570	standard deviation	ng/cig	Not Applicable
N-nitrosonornicotine (NNN)	7.954	0.375	standard deviation	ng/cig	Not Applicable
Toluene	1.384	0.230	standard deviation	µg/cig	Not Applicable

AEROSOL (ISO REGIMEN) REPORT WORKSHEET (1680395)

HPHC Name	CAS Code	FDA UNII Code	Smoking Machine	Number of Cigarettes per Smoke Trap	Number of Smoke Traps per Replicate	Number of Replicate Measurements	Test Start Date	Test End Date
Acetaldehyde	75-07-0	GO1N1ZPR3B	Linear	2	1	7	12/04/2016	19/04/2016
Acrolein	107-02-8	7864XYD3JJ	Linear	2	1	7	12/04/2016	19/04/2016
Acrylonitrile	107-13-1	MP1U0D42PE	Linear	10	1	7	01/04/2016	04/04/2016
4-Aminobiphenyl	92-67-1	16054949HJ	Linear	10	1	7	07/04/2016	11/04/2016
1-Aminonaphthalene	134-32-7	9753I242R5	Linear	10	1	7	07/04/2016	11/04/2016
2-Aminonaphthalene	91-59-8	CKR7XL41N4	Linear	10	1	7	07/04/2016	11/04/2016
Ammonia	7664-41-7	5138Q19F1X	Linear	5	1	7	05/04/2016	07/04/2016
Benzene	71-43-2	J64922108F	Linear	10	1	7	01/04/2016	04/04/2016
Benzo[a]pyrene	50-32-8	3417WMA06D	Linear	5	1	7	02/04/2016	08/04/2016
1,3-Butadiene	106-99-0	JSD5FGP5VD	Linear	10	1	7	01/04/2016	04/04/2016
Carbon monoxide	630-08-0	7U1EE4V452	Linear	5	1	20	30/03/2016	31/03/2016
Crotonaldehyde	4170-30-3	9G72074TUW	Linear	2	1	7	12/04/2016	19/04/2016
Formaldehyde	50-00-0	1HG84L3525	Linear	2	1	7	12/04/2016	19/04/2016
Isoprene	78-79-5	0A62964IBU	Linear	10	1	7	01/04/2016	04/04/2016
Nicotine (total)	54-11-5	6M3C89ZY6R	Linear	5	1	20	30/03/2016	31/03/2016
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	7S395EDO61	Linear	5	1	7	06/04/2016	11/04/2016
N-nitrosonornicotine (NNN)	16543-55-8	X656TZ86DX	Linear	5	1	7	06/04/2016	11/04/2016
Toluene	108-88-3	3FPU23BG52	Linear	10	1	7	01/04/2016	04/04/2016

HPHC Name	Method of Extraction	Method of Separation	If "Other" Method of Separation, Specify	Method of Detection	If "Other" Method of Detection, Specify
Acetaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrolein	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrylonitrile	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
4-Aminobiphenyl	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
1-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
2-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
Ammonia	Health Canada Method T-101; Extract with 0.05N H2SO4, 30 min.	IC	Not Applicable	Other	CD: Conductivity detection
Benzene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Benzo[a]pyrene	NS235_Report.pdf Section 6.3.3.1; methanol, shake 30 min + sonicate 15 min.	GC	Not Applicable	MSD	Not Applicable
1,3-Butadiene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Carbon monoxide	Health Canada Method T-115 (ISO 4387, 8454); direct vapour phase collection	Not Applicable	Not Applicable	NDIR	Not Applicable
Crotonaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Formaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Isoprene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Nicotine (total)	Health Canada Method T-115 (ISO 4387, 10315); isopropanol, 45 min.	GC	Not Applicable	FID	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
N-nitrosonornicotine (NNN)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
Toluene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable

HPHC Name	Mean Quantity of HPHC per Cigarette	Variance of Mean HPHC Quantity	Type of Variance	Unit of Measurement - Mean & Variance	If "Other" Unit of Measurement Mean & Variance, Specify
Acetaldehyde	128.618	6.221	standard deviation	µg/cig	Not Applicable
Acrolein	3.932	0.423	standard deviation	µg/cig	Not Applicable
Acrylonitrile	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
4-Aminobiphenyl	0.006	0.002	standard deviation	ng/cig	Not Applicable
1-Aminonaphthalene	0.028	0.017	standard deviation	ng/cig	Not Applicable
2-Aminonaphthalene	0.021	0.019	standard deviation	ng/cig	Not Applicable
Ammonia	1.404	0.231	standard deviation	µg/cig	Not Applicable
Benzene	0.287	0.124	standard deviation	µg/cig	Not Applicable
Benzo[a]pyrene	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
1,3-Butadiene	0.115	0.013	standard deviation	µg/cig	Not Applicable
Carbon monoxide	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Crotonaldehyde	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Formaldehyde	12.119	0.354	standard deviation	µg/cig	Not Applicable
Isoprene	0.997	0.181	standard deviation	µg/cig	Not Applicable
Nicotine (total)	0.392	0.031	standard deviation	mg/cig	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	3.082	0.291	standard deviation	ng/cig	Not Applicable
N-nitrosonornicotine (NNN)	3.448	0.335	standard deviation	ng/cig	Not Applicable
Toluene	0.845	0.322	standard deviation	µg/cig	Not Applicable

AEROSOL REPORT (INTENSE REGIMEN) WORKSHEET (1680395)

HPHC Name	CAS Code	FDA UNII Code	Smoking Machine	Number of Cigarettes per Smoke Trap	Number of Smoke Traps per Replicate	Number of Replicate Measurements	Test Start Date	Test End Date
Acetaldehyde	75-07-0	GO1N1ZPR3B	Linear	2	1	7	17/04/2016	20/04/2016
Acrolein	107-02-8	7864XYD3JJ	Linear	2	1	7	17/04/2016	20/04/2016
Acrylonitrile	107-13-1	MP1U0D42PE	Linear	10	1	7	31/03/2016	04/04/2016
4-Aminobiphenyl	92-67-1	16054949HJ	Linear	10	1	7	31/03/2016	05/04/2016
1-Aminonaphthalene	134-32-7	9753I242R5	Linear	10	1	7	31/03/2016	05/04/2016
2-Aminonaphthalene	91-59-8	CKR7XL41N4	Linear	10	1	7	31/03/2016	05/04/2016
Ammonia	7664-41-7	5138Q19F1X	Linear	5	1	7	04/04/2016	06/04/2016
Benzene	71-43-2	J64922108F	Linear	10	1	7	31/03/2016	04/04/2016
Benzo[a]pyrene	50-32-8	3417WMA06D	Linear	5	1	7	30/03/2016	09/04/2016
1,3-Butadiene	106-99-0	JSD5FGP5VD	Linear	10	1	7	31/03/2016	04/04/2016
Carbon monoxide	630-08-0	7U1EE4V452	Linear	5	1	20	07/04/2016	11/04/2016
Crotonaldehyde	4170-30-3	9G72074TUW	Linear	2	1	7	17/04/2016	20/04/2016
Formaldehyde	50-00-0	1HG84L3525	Linear	2	1	7	17/04/2016	20/04/2016
Isoprene	78-79-5	0A62964IBU	Linear	10	1	7	31/03/2016	04/04/2016
Nicotine (total)	54-11-5	6M3C89ZY6R	Linear	5	1	20	07/04/2016	11/04/2016
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	7S395EDO61	Linear	5	1	7	11/04/2016	12/04/2016
N-nitrosonornicotine (NNN)	16543-55-8	X656TZ86DX	Linear	5	1	7	11/04/2016	12/04/2016
Toluene	108-88-3	3FPU23BG52	Linear	10	1	7	31/03/2016	04/04/2016

HPHC Name	Method of Extraction	Method of Separation	If "Other" Method of Separation, Specify	Method of Detection	If "Other" Method of Detection, Specify
Acetaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrolein	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrylonitrile	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
4-Aminobiphenyl	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
1-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
2-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
Ammonia	Health Canada Method T-101; Extract with 0.05N H2SO4, 30 min.	IC	Not Applicable	Other	CD: Conductivity detection
Benzene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Benzo[a]pyrene	NS235_Report.pdf Section 6.3.3.1; methanol, shake 30 min + sonicate 15 min.	GC	Not Applicable	MSD	Not Applicable
1,3-Butadiene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Carbon monoxide	Health Canada Method T-115 (ISO 4387, 8454); direct vapour phase collection	Not Applicable	Not Applicable	NDIR	Not Applicable
Crotonaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Formaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Isoprene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Nicotine (total)	Health Canada Method T-115 (ISO 4387, 10315); isopropanol, 45 min.	GC	Not Applicable	FID	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
N-nitrosonornicotine (NNN)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
Toluene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable

HPHC Name	Mean Quantity of HPHC per Cigarette	Variance of Mean HPHC Quantity	Type of Variance	Unit of Measurement - Mean & Variance	If "Other" Unit of Measurement Mean & Variance, Specify
Acetaldehyde	198.920	11.866	standard deviation	µg/cig	Not Applicable
Acrolein	9.492	1.249	standard deviation	µg/cig	Not Applicable
Acrylonitrile	0.128	0.029	standard deviation	µg/cig	Not Applicable
4-Aminobiphenyl	0.009	0.002	standard deviation	ng/cig	Not Applicable
1-Aminonaphthalene	0.036	0.009	standard deviation	ng/cig	Not Applicable
2-Aminonaphthalene	0.017	0.006	standard deviation	ng/cig	Not Applicable
Ammonia	11.843	1.036	standard deviation	µg/cig	Not Applicable
Benzene	0.476	0.050	standard deviation	µg/cig	Not Applicable
Benzo[a]pyrene	0.585	0.044	standard deviation	ng/cig	Not Applicable
1,3-Butadiene	0.218	0.024	standard deviation	µg/cig	Not Applicable
Carbon monoxide	0.331	0.041	standard deviation	mg/cig	Not Applicable
Crotonaldehyde	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Formaldehyde	15.403	1.429	standard deviation	µg/cig	Not Applicable
Isoprene	1.503	0.223	standard deviation	µg/cig	Not Applicable
Nicotine (total)	1.136	0.058	standard deviation	mg/cig	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	7.657	0.479	standard deviation	ng/cig	Not Applicable
N-nitrosonornicotine (NNN)	8.869	0.533	standard deviation	ng/cig	Not Applicable
Toluene	1.313	0.132	standard deviation	µg/cig	Not Applicable

AEROSOL (ISO REGIMEN) REPORT WORKSHEET (1680396)

HPHC Name	CAS Code	FDA UNII Code	Smoking Machine	Number of Cigarettes per Smoke Trap	Number of Smoke Traps per Replicate	Number of Replicate Measurements	Test Start Date	Test End Date
Acetaldehyde	75-07-0	GO1N1ZPR3B	Linear	2	1	7	12/04/2016	19/04/2016
Acrolein	107-02-8	7864XYD3JJ	Linear	2	1	7	12/04/2016	19/04/2016
Acrylonitrile	107-13-1	MP1U0D42PE	Linear	10	1	7	01/04/2016	04/04/2016
4-Aminobiphenyl	92-67-1	16054949HJ	Linear	10	1	7	07/04/2016	11/04/2016
1-Aminonaphthalene	134-32-7	9753I242R5	Linear	10	1	7	07/04/2016	11/04/2016
2-Aminonaphthalene	91-59-8	CKR7XL41N4	Linear	10	1	7	07/04/2016	11/04/2016
Ammonia	7664-41-7	5138Q19F1X	Linear	5	1	7	05/04/2016	07/04/2016
Benzene	71-43-2	J64922108F	Linear	10	1	7	01/04/2016	04/04/2016
Benzo[a]pyrene	50-32-8	3417WMA06D	Linear	5	1	7	02/04/2016	08/04/2016
1,3-Butadiene	106-99-0	JSD5FGP5VD	Linear	10	1	7	01/04/2016	04/04/2016
Carbon monoxide	630-08-0	7U1EE4V452	Linear	5	1	20	30/03/2016	31/03/2016
Crotonaldehyde	4170-30-3	9G72074TUW	Linear	2	1	7	12/04/2016	19/04/2016
Formaldehyde	50-00-0	1HG84L3525	Linear	2	1	7	12/04/2016	19/04/2016
Isoprene	78-79-5	0A62964IBU	Linear	10	1	7	01/04/2016	04/04/2016
Nicotine (total)	54-11-5	6M3C89ZY6R	Linear	5	1	20	30/03/2016	31/03/2016
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	7S395EDO61	Linear	5	1	7	06/04/2016	11/04/2016
N-nitrosonornicotine (NNN)	16543-55-8	X656TZ86DX	Linear	5	1	7	06/04/2016	11/04/2016
Toluene	108-88-3	3FPU23BG52	Linear	10	1	7	01/04/2016	04/04/2016

HPHC Name	Method of Extraction	Method of Separation	If "Other" Method of Separation, Specify	Method of Detection	If "Other" Method of Detection, Specify
Acetaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrolein	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrylonitrile	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
4-Aminobiphenyl	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
1-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
2-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
Ammonia	Health Canada Method T-101; Extract with 0.05N H2SO4, 30 min.	IC	Not Applicable	Other	CD: Conductivity detection
Benzene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Benzo[a]pyrene	NS235_Report.pdf Section 6.3.3.1; methanol, shake 30 min + sonicate 15 min.	GC	Not Applicable	MSD	Not Applicable
1,3-Butadiene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Carbon monoxide	Health Canada Method T-115 (ISO 4387, 8454); direct vapour phase collection	Not Applicable	Not Applicable	NDIR	Not Applicable
Crotonaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Formaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Isoprene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Nicotine (total)	Health Canada Method T-115 (ISO 4387, 10315); isopropanol, 45 min.	GC	Not Applicable	FID	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
N-nitrosonornicotine (NNN)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
Toluene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable

HPHC Name	Mean Quantity of HPHC per Cigarette	Variance of Mean HPHC Quantity	Type of Variance	Unit of Measurement - Mean & Variance	If "Other" Unit of Measurement Mean & Variance, Specify
Acetaldehyde	125.997	4.449	standard deviation	µg/cig	Not Applicable
Acrolein	3.918	0.204	standard deviation	µg/cig	Not Applicable
Acrylonitrile	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
4-Aminobiphenyl	0.005	0.001	standard deviation	ng/cig	Not Applicable
1-Aminonaphthalene	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
2-Aminonaphthalene	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Ammonia	1.229	0.094	standard deviation	µg/cig	Not Applicable
Benzene	0.230	0.053	standard deviation	µg/cig	Not Applicable
Benzo[a]pyrene	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
1,3-Butadiene	0.110	0.010	standard deviation	µg/cig	Not Applicable
Carbon monoxide	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Crotonaldehyde	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Formaldehyde	12.032	0.205	standard deviation	µg/cig	Not Applicable
Isoprene	0.929	0.061	standard deviation	µg/cig	Not Applicable
Nicotine (total)	0.381	0.031	standard deviation	mg/cig	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	2.877	0.268	standard deviation	ng/cig	Not Applicable
N-nitrosonornicotine (NNN)	3.266	0.241	standard deviation	ng/cig	Not Applicable
Toluene	0.658	0.219	standard deviation	µg/cig	Not Applicable

AEROSOL REPORT (INTENSE REGIMEN) WORKSHEET (1680396)

HPHC Name	CAS Code	FDA UNII Code	Smoking Machine	Number of Cigarettes per Smoke Trap	Number of Smoke Traps per Replicate	Number of Replicate Measurements	Test Start Date	Test End Date
Acetaldehyde	75-07-0	GO1N1ZPR3B	Linear	2	1	7	17/04/2016	20/04/2016
Acrolein	107-02-8	7864XYD3JJ	Linear	2	1	7	17/04/2016	20/04/2016
Acrylonitrile	107-13-1	MP1U0D42PE	Linear	10	1	7	31/03/2016	04/04/2016
4-Aminobiphenyl	92-67-1	16054949HJ	Linear	10	1	7	31/03/2016	05/04/2016
1-Aminonaphthalene	134-32-7	9753I242R5	Linear	10	1	7	31/03/2016	05/04/2016
2-Aminonaphthalene	91-59-8	CKR7XL41N4	Linear	10	1	7	31/03/2016	05/04/2016
Ammonia	7664-41-7	5138Q19F1X	Linear	5	1	7	04/04/2016	06/04/2016
Benzene	71-43-2	J64922108F	Linear	10	1	7	31/03/2016	04/04/2016
Benzo[a]pyrene	50-32-8	3417WMA06D	Linear	5	1	7	30/03/2016	09/04/2016
1,3-Butadiene	106-99-0	JSD5FGP5VD	Linear	10	1	7	31/03/2016	04/04/2016
Carbon monoxide	630-08-0	7U1EE4V452	Linear	5	1	20	07/04/2016	11/04/2016
Crotonaldehyde	4170-30-3	9G72074TUW	Linear	2	1	7	17/04/2016	20/04/2016
Formaldehyde	50-00-0	1HG84L3525	Linear	2	1	7	17/04/2016	20/04/2016
Isoprene	78-79-5	0A62964IBU	Linear	10	1	7	31/03/2016	04/04/2016
Nicotine (total)	54-11-5	6M3C89ZY6R	Linear	5	1	20	07/04/2016	11/04/2016
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	7S395EDO61	Linear	5	1	7	11/04/2016	12/04/2016
N-nitrosonornicotine (NNN)	16543-55-8	X656TZ86DX	Linear	5	1	7	11/04/2016	12/04/2016
Toluene	108-88-3	3FPU23BG52	Linear	10	1	7	31/03/2016	04/04/2016

HPHC Name	Method of Extraction	Method of Separation	If "Other" Method of Separation, Specify	Method of Detection	If "Other" Method of Detection, Specify
Acetaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrolein	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Acrylonitrile	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
4-Aminobiphenyl	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
1-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
2-Aminonaphthalene	NS235_Report.pdf Section 6.3.3.2; Extract in 5% HCl, 30 min.	GC	Not Applicable	MSD	Not Applicable
Ammonia	Health Canada Method T-101; Extract with 0.05N H2SO4, 30 min.	IC	Not Applicable	Other	CD: Conductivity detection
Benzene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Benzo[a]pyrene	NS235_Report.pdf Section 6.3.3.1; methanol, shake 30 min + sonicate 15 min.	GC	Not Applicable	MSD	Not Applicable
1,3-Butadiene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Carbon monoxide	Health Canada Method T-115 (ISO 4387, 8454); direct vapour phase collection	Not Applicable	Not Applicable	NDIR	Not Applicable
Crotonaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Formaldehyde	Health Canada Method T-104; 12mM acidified DNPH in acetonitrile trap	HPLC	Not Applicable	UVD	Not Applicable
Isoprene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable
Nicotine (total)	Health Canada Method T-115 (ISO 4387, 10315); isopropanol, 45 min.	GC	Not Applicable	FID	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
N-nitrosonornicotine (NNN)	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.	HPLC	Not Applicable	MSMS	Not Applicable
Toluene	Health Canada Method T-116; Gas phase collected into cryogenic methanol trap	GC	Not Applicable	MSD	Not Applicable

HPHC Name	Mean Quantity of HPHC per Cigarette	Variance of Mean HPHC Quantity	Type of Variance	Unit of Measurement - Mean & Variance	If "Other" Unit of Measurement Mean & Variance, Specify
Acetaldehyde	199.037	6.734	standard deviation	µg/cig	Not Applicable
Acrolein	9.307	0.677	standard deviation	µg/cig	Not Applicable
Acrylonitrile	0.139	0.025	standard deviation	µg/cig	Not Applicable
4-Aminobiphenyl	0.008	0.002	standard deviation	ng/cig	Not Applicable
1-Aminonaphthalene	0.036	0.006	standard deviation	ng/cig	Not Applicable
2-Aminonaphthalene	0.017	0.007	standard deviation	ng/cig	Not Applicable
Ammonia	10.952	0.822	standard deviation	µg/cig	Not Applicable
Benzene	0.518	0.069	standard deviation	µg/cig	Not Applicable
Benzo[a]pyrene	0.521	0.059	standard deviation	ng/cig	Not Applicable
1,3-Butadiene	0.237	0.030	standard deviation	µg/cig	Not Applicable
Carbon monoxide	0.324	0.008	standard deviation	mg/cig	Not Applicable
Crotonaldehyde	0.000	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Formaldehyde	14.837	0.556	standard deviation	µg/cig	Not Applicable
Isoprene	1.680	0.215	standard deviation	µg/cig	Not Applicable
Nicotine (total)	1.096	0.050	standard deviation	mg/cig	Not Applicable
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	6.337	0.512	standard deviation	ng/cig	Not Applicable
N-nitrosonornicotine (NNN)	7.771	0.706	standard deviation	ng/cig	Not Applicable
Toluene	1.555	0.285	standard deviation	µg/cig	Not Applicable

Table 1b: **Yields of 'Tar', Nicotine and CO in Mainstream Tobacco Smoke: 'ISO' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	CO [mg/cig]	Water [mg/cig]	Nicotine [mg/cig]	Tar [mg/cig]
1680394	835	6.0	26.2	0.270	13.6	0.435	12.2
1680394	847	6.0	25.5	0.250	14.7	0.418	10.4
1680394	823	6.0	24.4	< 0.223 but ≥ 0.067	14.7	0.408	9.30
1680394	840	6.0	24.5	0.250	12.8	0.381	11.3
1680394	836	6.0	25.4	< 0.223 but ≥ 0.067	13.9	0.404	11.2
1680394	836	6.0	25.4	0.250	13.0	0.399	12.0
1680394	836	6.0	21.8	< 0.223 but ≥ 0.067	11.2	0.301	10.2
1680394	832	6.0	27.2	0.250	15.6	0.435	11.2
1680394	826	6.0	24.4	< 0.223 but ≥ 0.067	12.8	0.340	11.3
1680394	845	6.0	27.1	0.250	14.4	0.382	12.3
1680394	832	6.0	28.2	0.250	15.5	0.399	12.3
1680394	831	6.0	26.7	0.250	14.1	0.384	12.2
1680394	834	6.0	26.2	< 0.223 but ≥ 0.067	15.0	0.390	10.8
1680394	840	6.0	28.3	< 0.223 but ≥ 0.067	15.1	0.408	12.8
1680394	831	6.0	24.2	0.250	14.0	0.390	9.88
1680394	832	6.0	27.0	0.250	14.4	0.456	12.1
1680394	839	6.0	25.9	< 0.223 but ≥ 0.067	15.8	0.382	9.65
1680394	852	6.0	26.8	< 0.223 but ≥ 0.067	14.8	0.355	11.7
1680394	846	6.0	26.8	0.250	14.2	0.384	12.2
1680394	843	6.0	26.9	0.250	14.5	0.406	12.1
Average	837	6.0	25.9	**NQ**	14.2	0.393	11.4
Std. Dev.	7	0.0	1.6	**NQ**	1.1	0.034	1.0
L. Limit (95%)	833	6.0	25.2	N/A	13.7	0.377	10.9
U. Limit (95%)	840	6.0	26.7	N/A	14.7	0.409	11.8

Table 1b: **Yields of 'Tar', Nicotine and CO in Mainstream Tobacco Smoke: 'ISO' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	CO [mg/cig]	Water [mg/cig]	Nicotine [mg/cig]	Tar [mg/cig]
1680395	824	6.0	24.6	0.250	14.2	0.397	9.95
1680395	835	6.0	25.9	0.250	13.6	0.401	11.8
1680395	819	6.0	25.7	< 0.223 but ≥ 0.067	14.1	0.405	11.3
1680395	829	6.0	26.1	0.250	13.5	0.410	12.3
1680395	823	6.0	26.2	0.250	13.8	0.419	12.0
1680395	833	6.0	24.1	0.250	13.1	0.362	10.7
1680395	826	6.0	26.4	< 0.223 but ≥ 0.067	15.1	0.387	11.0
1680395	831	6.0	27.1	< 0.223 but ≥ 0.067	15.6	0.398	11.1
1680395	834	6.0	28.7	< 0.223 but ≥ 0.067	16.8	0.414	11.5
1680395	826	6.0	27.8	< 0.223 but ≥ 0.067	15.1	0.421	12.3
1680395	836	6.0	25.2	< 0.223 but ≥ 0.067	12.9	0.372	11.9
1680395	841	6.0	24.2	< 0.223 but ≥ 0.067	12.9	0.349	11.0
1680395	840	6.0	22.9	< 0.223 but ≥ 0.067	13.2	0.356	9.41
1680395	823	6.0	23.2	< 0.223 but ≥ 0.067	13.9	0.363	8.94
1680395	843	6.0	23.4	0.250	12.7	0.353	10.3
1680395	833	6.0	27.3	0.250	15.0	0.424	11.9
1680395	828	6.0	23.5	< 0.223 but ≥ 0.067	12.8	0.347	10.4
1680395	843	6.0	27.0	< 0.223 but ≥ 0.067	14.3	0.402	12.3
1680395	825	6.0	27.5	0.250	16.4	0.464	10.5
1680395	825	6.0	25.8	< 0.223 but ≥ 0.067	14.9	0.400	10.5
Average	831	6.0	25.6	**NQ**	14.2	0.392	11.1
Std. Dev.	7	0.0	1.7	**NQ**	1.2	0.031	1.0
L. Limit (95%)	828	6.0	24.8	N/A	13.6	0.378	10.6
U. Limit (95%)	834	6.0	26.4	N/A	14.8	0.407	11.5

Table 1b: **Yields of 'Tar', Nicotine and CO in Mainstream Tobacco Smoke: 'ISO' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	CO [mg/cig]	Water [mg/cig]	Nicotine [mg/cig]	Tar [mg/cig]
1680396	845	6.0	23.7	0.300	13.5	0.359	9.87
1680396	844	6.0	25.8	0.250	13.3	0.386	12.1
1680396	833	6.0	24.8	0.250	12.9	0.391	11.4
1680396	837	6.0	24.7	0.250	12.9	0.402	11.4
1680396	841	6.0	26.0	0.270	13.4	0.365	12.2
1680396	850	6.0	26.0	0.250	14.4	0.387	11.2
1680396	841	6.0	23.3	< 0.223 but ≥ 0.067	13.8	0.338	9.11
1680396	830	6.0	25.5	< 0.223 but ≥ 0.067	13.5	0.342	11.6
1680396	844	6.0	25.1	< 0.223 but ≥ 0.067	12.8	0.329	11.9
1680396	840	6.0	25.0	0.250	13.3	0.374	11.3
1680396	833	6.0	25.9	0.250	13.5	0.382	12.1
1680396	833	6.0	25.4	< 0.223 but ≥ 0.067	14.2	0.372	10.7
1680396	856	6.0	24.1	< 0.223 but ≥ 0.067	14.2	0.363	9.54
1680396	831	6.0	24.1	0.250	14.7	0.420	9.00
1680396	832	6.0	29.6	< 0.223 but ≥ 0.067	15.7	0.444	13.4
1680396	825	6.0	25.7	< 0.223 but ≥ 0.067	14.8	0.390	10.5
1680396	826	6.0	26.5	0.250	14.7	0.439	11.4
1680396	851	6.0	24.4	< 0.223 but ≥ 0.067	13.6	0.351	10.4
1680396	834	6.0	25.8	0.250	14.3	0.408	11.0
1680396	827	6.0	25.6	< 0.223 but ≥ 0.067	14.5	0.385	10.8
Average	838	6.0	25.4	**NQ**	13.9	0.381	11.1
Std. Dev.	9	0.0	1.3	**NQ**	0.8	0.031	1.1
L. Limit (95%)	834	6.0	24.7	N/A	13.6	0.367	10.5
U. Limit (95%)	842	6.0	26.0	N/A	14.3	0.396	11.6

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
NQ: Below the Limit of Quantification
N/A: Not Applicable

Table 1b: **Yields of 'Tar', Nicotine and CO in Mainstream Tobacco Smoke: 'Intense' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	CO [mg/cig]	Water [mg/cig]	Nicotine [mg/cig]	Tar [mg/cig]
1680394	842	12.0	56.2	0.320	30.3	1.05	24.8
1680394	835	12.0	54.3	0.320	33.8	1.00	19.5
1680394	844	12.0	57.1	0.320	29.5	1.06	26.5
1680394	841	12.0	55.9	0.320	31.9	1.08	22.9
1680394	840	12.0	53.8	0.320	27.3	0.975	25.6
1680394	837	12.0	56.6	0.320	29.0	1.05	26.6
1680394	839	12.0	58.7	0.320	29.4	1.16	28.1
1680394	845	12.0	59.3	0.320	32.3	1.14	25.8
1680394	829	12.0	58.9	0.320	30.0	1.06	27.8
1680394	850	12.0	58.7	0.400	31.9	1.10	25.7
1680394	860	12.0	59.2	0.420	30.5	1.13	27.6
1680394	844	12.0	54.9	0.320	27.3	1.06	26.6
1680394	832	12.0	56.4	0.320	26.8	1.07	28.5
1680394	833	12.0	57.3	0.320	30.0	1.08	26.2
1680394	837	12.0	57.4	0.320	28.0	1.10	28.2
1680394	834	12.0	57.2	0.320	30.4	1.13	25.7
1680394	850	12.0	58.4	0.340	33.4	1.000	24.0
1680394	843	12.0	56.2	0.320	35.8	1.04	19.4
1680394	842	12.0	56.3	0.400	30.1	1.06	25.1
1680394	846	12.0	63.0	0.400	31.4	1.09	30.5
Average	841	12.0	57.3	0.338	30.4	1.07	25.8
Std. Dev.	7	0.0	2.1	0.035	2.3	0.05	2.7
L. Limit (95%)	838	12.0	56.3	0.322	29.4	1.05	24.5
U. Limit (95%)	844	12.0	58.2	0.354	31.5	1.09	27.0

Table 1b: **Yields of 'Tar', Nicotine and CO in Mainstream Tobacco Smoke: 'Intense' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	CO [mg/cig]	Water [mg/cig]	Nicotine [mg/cig]	Tar [mg/cig]
1680395	842	12.0	55.0	0.420	28.8	1.13	25.1
1680395	834	12.0	54.8	0.340	30.0	1.11	23.7
1680395	848	12.0	57.2	0.320	27.5	1.16	28.6
1680395	833	12.0	56.3	0.320	27.3	1.12	27.9
1680395	828	12.0	57.8	0.320	29.8	1.21	26.7
1680395	842	12.0	57.1	0.320	33.9	1.13	22.1
1680395	834	12.0	57.9	0.420	34.4	1.06	22.5
1680395	837	12.0	58.7	0.340	35.1	1.06	22.5
1680395	845	12.0	58.3	0.320	29.9	1.19	27.2
1680395	824	12.0	55.3	0.320	31.8	1.13	22.3
1680395	836	12.0	53.6	0.320	28.1	1.02	24.5
1680395	831	12.0	56.5	0.320	34.5	1.10	21.0
1680395	843	12.0	58.5	0.240	32.7	1.14	24.7
1680395	838	12.0	58.2	0.320	29.7	1.13	27.4
1680395	847	12.0	58.2	0.320	29.7	1.19	27.3
1680395	845	12.0	58.2	0.400	30.3	1.19	26.8
1680395	829	12.0	56.4	0.300	32.7	1.12	22.5
1680395	832	12.0	57.4	0.320	32.9	1.13	23.4
1680395	841	12.0	60.5	0.320	30.3	1.12	29.1
1680395	824	12.0	61.6	0.310	30.8	1.29	29.4
Average	837	12.0	57.4	0.331	31.0	1.14	25.2
Std. Dev.	7	0.0	1.9	0.041	2.4	0.06	2.7
L. Limit (95%)	833	12.0	56.5	0.311	29.9	1.11	24.0
U. Limit (95%)	840	12.0	58.3	0.350	32.1	1.16	26.5

Table 1b: **Yields of 'Tar', Nicotine and CO in Mainstream Tobacco Smoke: 'Intense' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	CO [mg/cig]	Water [mg/cig]	Nicotine [mg/cig]	Tar [mg/cig]
1680396	847	12.0	56.7	0.320	31.7	1.03	23.9
1680396	853	12.0	57.8	0.320	31.4	1.07	25.4
1680396	838	12.0	56.9	0.320	29.9	1.04	26.0
1680396	843	12.0	57.9	0.320	29.0	1.14	27.8
1680396	860	12.0	58.7	0.340	33.6	1.16	23.9
1680396	845	12.0	54.7	0.340	29.3	1.05	24.4
1680396	840	12.0	55.9	0.320	29.2	1.06	25.6
1680396	847	12.0	56.9	0.320	31.3	1.12	24.4
1680396	847	12.0	56.0	0.320	27.4	1.01	27.6
1680396	855	12.0	57.8	0.320	31.5	1.14	25.1
1680396	852	12.0	59.1	0.320	28.8	1.12	29.2
1680396	849	12.0	56.1	0.320	33.7	1.12	21.3
1680396	843	12.0	61.8	0.340	39.0	1.04	21.8
1680396	854	12.0	64.6	0.340	36.9	1.17	26.6
1680396	843	12.0	57.9	0.320	32.2	1.12	24.5
1680396	840	12.0	57.0	0.320	30.9	1.07	25.0
1680396	846	12.0	57.5	0.320	32.5	1.13	23.9
1680396	841	12.0	64.7	0.320	36.8	1.17	26.7
1680396	838	12.0	65.6	0.320	33.6	1.13	30.8
1680396	843	12.0	59.0	0.320	29.5	1.04	28.4
Average	846	12.0	58.6	0.324	31.9	1.10	25.6
Std. Dev.	6	0.0	3.1	0.008	3.0	0.05	2.4
L. Limit (95%)	843	12.0	57.2	0.320	30.5	1.07	24.5
U. Limit (95%)	849	12.0	60.1	0.328	33.3	1.12	26.7

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Table 2a: **Yields of Selected 'Carbonyls' in Mainstream Tobacco Smoke: 'ISO' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	Formaldehyde [µg/cig]	Acetaldehyde [µg/cig]	Acrolein [µg/cig]	Crotonaldehyde [µg/cig]
1680394	841	6.0	11.9	128	4.42	< 0.988
1680394	824	6.0	11.7	126	4.31	< 0.988
1680394	834	6.0	12.3	127	4.40	< 3.29 but ≥ 0.988
1680394	832	6.0	12.2	132	4.61	< 3.29 but ≥ 0.988
1680394	819	6.0	11.7	122	3.98	< 3.29 but ≥ 0.988
1680394	837	6.0	12.1	123	3.45	< 0.988
1680394	842	6.0	11.5	115	3.25	< 3.29 but ≥ 0.988
Average	833	6.0	11.9	125	4.06	**NQ**
Std. Dev.	9	0.0	0.3	5	0.53	**NQ**
L. Limit (95%)	825	6.0	11.6	120	3.57	N/A
U. Limit (95%)	841	6.0	12.2	129	4.55	N/A
1680395	821	6.0	12.6	137	4.43	< 0.988
1680395	822	6.0	12.2	132	4.17	< 0.988
1680395	815	6.0	11.7	117	3.27	< 3.29 but ≥ 0.988
1680395	834	6.0	12.4	128	3.91	< 3.29 but ≥ 0.988
1680395	829	6.0	12.1	127	4.25	< 0.988
1680395	803	6.0	12.3	132	4.03	< 0.988
1680395	815	6.0	11.6	128	3.47	< 3.29 but ≥ 0.988
Average	820	6.0	12.1	129	3.93	**NQ**
Std. Dev.	10	0.0	0.4	6	0.42	**NQ**
L. Limit (95%)	811	6.0	11.8	123	3.54	N/A
U. Limit (95%)	829	6.0	12.4	134	4.32	N/A

Table 2a: **Yields of Selected 'Carbonyls' in Mainstream Tobacco Smoke: 'ISO' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	Formaldehyde [µg/cig]	Acetaldehyde [µg/cig]	Acrolein [µg/cig]	Crotonaldehyde [µg/cig]
1680396	839	6.0	11.8	128	3.99	< 3.29 but ≥ 0.988
1680396	855	6.0	11.9	118	3.76	< 0.988
1680396	832	6.0	11.9	125	3.66	< 0.988
1680396	836	6.0	12.2	127	4.23	< 0.988
1680396	842	6.0	11.9	123	3.84	< 0.988
1680396	850	6.0	12.3	131	4.12	< 3.29 but ≥ 0.988
1680396	849	6.0	12.3	130	3.83	< 3.29 but ≥ 0.988
Average	843	6.0	12.0	126	3.92	**NQ**
Std. Dev.	8	0.0	0.2	4	0.20	**NQ**
L. Limit (95%)	835	6.0	11.8	122	3.73	N/A
U. Limit (95%)	851	6.0	12.2	130	4.11	N/A

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
NQ: Below the Limit of Quantification
N/A: Not Applicable

Note Regarding EZ Isomerism of Acetaldehyde:
Recent studies have demonstrated a previously unidentified peak to be an isomer of the acetaldehyde hydrazone. Consistent with current practice and the Coresta recommended method (CRM 74), results for acetaldehyde will be increased to reflect the inclusion of this isomer. For comparison to historical data, results from previous projects should be adjusted by 1.27 which takes into account the typical average contribution of the isomer.

Table 2a: **Yields of Selected 'Carbonyls' in Laboratory Reagent Blank: 'ISO' Conditions***

Sample ID	Formaldehyde [µg/cig]	Acetaldehyde [µg/cig]	Acrolein [µg/cig]	Crotonaldehyde [µg/cig]
LRB	9.25	3.30	< 0.713	< 0.988
Average	9.25	3.30	**BDL**	**BDL**
Std. Dev.	ND	ND	**BDL**	**BDL**
L. Limit (95%)	ND	ND	ND	ND
U. Limit (95%)	ND	ND	ND	ND

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
BDL: Below the Limit of Detection
ND: Not Defined

Note Regarding EZ Isomerism of Acetaldehyde:
Recent studies have demonstrated a previously unidentified peak to be an isomer of the acetaldehyde hydrazone. Consistent with current practice and the Coresta recommended method (CRM 74), results for acetaldehyde will be increased to reflect the inclusion of this isomer. For comparison to historical data, results from previous projects should be adjusted by 1.27 which takes into account the typical average contribution of the isomer.

Table 2b: **Yields of Selected 'Carbonyls' in Mainstream Tobacco Smoke: 'Intense' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	Formaldehyde [µg/cig]	Acetaldehyde [µg/cig]	Acrolein [µg/cig]	Crotonaldehyde [µg/cig]
1680394	847	12.0	13.9	189	8.07	< 3.29 but ≥ 0.988
1680394	834	12.0	15.1	202	8.86	< 3.29 but ≥ 0.988
1680394	835	12.0	14.7	190	8.27	< 3.29 but ≥ 0.988
1680394	825	12.0	14.5	193	8.64	< 3.29 but ≥ 0.988
1680394	850	12.0	13.1	179	7.49	< 3.29 but ≥ 0.988
1680394	829	12.0	14.6	169	9.12	< 3.29 but ≥ 0.988
1680394	841	12.0	12.4	187	8.59	< 3.29 but ≥ 0.988
Average	837	12.0	14.0	187	8.43	**NQ**
Std. Dev.	9	0.0	1.0	11	0.54	**NQ**
L. Limit (95%)	829	12.0	13.1	177	7.93	N/A
U. Limit (95%)	846	12.0	14.9	197	8.93	N/A
1680395	827	12.0	13.8	197	9.95	< 3.29 but ≥ 0.988
1680395	853	12.0	14.3	212	10.8	< 3.29 but ≥ 0.988
1680395	843	12.0	15.1	223	10.7	< 3.29 but ≥ 0.988
1680395	841	12.0	13.5	204	12.9	< 3.29 but ≥ 0.988
1680395	839	12.0	14.9	200	9.82	< 3.29 but ≥ 0.988
1680395	832	12.0	13.3	197	9.15	< 3.29 but ≥ 0.988
1680395	823	12.0	13.7	193	8.97	< 3.29 but ≥ 0.988
Average	837	12.0	14.1	204	10.3	**NQ**
Std. Dev.	10	0.0	0.7	10	1.3	**NQ**
L. Limit (95%)	827	12.0	13.4	194	9.1	N/A
U. Limit (95%)	846	12.0	14.7	213	11.5	N/A

Table 2b: **Yields of Selected 'Carbonyls' in Mainstream Tobacco Smoke: 'Intense' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	Formaldehyde [µg/cig]	Acetaldehyde [µg/cig]	Acrolein [µg/cig]	Crotonaldehyde [µg/cig]
1680396	841	12.0	12.5	198	8.35	< 3.29 but ≥ 0.988
1680396	829	12.0	12.9	187	8.70	< 3.29 but ≥ 0.988
1680396	831	12.0	15.0	181	9.32	< 3.29 but ≥ 0.988
1680396	859	12.0	15.2	194	8.75	< 3.29 but ≥ 0.988
1680396	829	12.0	13.9	193	8.86	< 3.29 but ≥ 0.988
1680396	840	12.0	14.1	186	8.87	< 3.29 but ≥ 0.988
1680396	849	12.0	12.9	193	8.91	< 3.29 but ≥ 0.988
Average	840	12.0	13.8	190	8.83	**NQ**
Std. Dev.	11	0.0	1.0	6	0.29	**NQ**
L. Limit (95%)	830	12.0	12.8	185	8.56	N/A
U. Limit (95%)	850	12.0	14.8	196	9.09	N/A

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
NQ: Below the Limit of Quantification
N/A: Not Applicable

Note Regarding EZ Isomerism of Acetaldehyde:
Recent studies have demonstrated a previously unidentified peak to be an isomer of the acetaldehyde hydrazone. Consistent with current practice and the Coresta recommended method (CRM 74), results for acetaldehyde will be increased to reflect the inclusion of this isomer. For comparison to historical data, results from previous projects should be adjusted by 1.27 which takes into account the typical average contribution of the isomer.

Table 2b: **Yields of Selected 'Carbonyls' in Laboratory Reagent Blank: 'Intense' Conditions***

Sample ID	Formaldehyde [µg/cig]	Acetaldehyde [µg/cig]	Acrolein [µg/cig]	Crotonaldehyde [µg/cig]
LRB	9.81	3.26	< 0.713	< 0.988
Average	9.81	3.26	**BDL**	**BDL**
Std. Dev.	ND	ND	**BDL**	**BDL**
L. Limit (95%)	ND	ND	ND	ND
U. Limit (95%)	ND	ND	ND	ND

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
BDL: Below the Limit of Detection
ND: Not Defined

Note Regarding EZ Isomerism of Acetaldehyde:
Recent studies have demonstrated a previously unidentified peak to be an isomer of the acetaldehyde hydrazone. Consistent with current practice and the Coresta recommended method (CRM 74), results for acetaldehyde will be increased to reflect the inclusion of this isomer. For comparison to historical data, results from previous projects should be adjusted by 1.27 which takes into account the typical average contribution of the isomer.

Table 8a: Yields of Ammonia in Mainstream Tobacco Smoke: 'ISO' Conditions*

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	Ammonia [µg/cig]
1680394	836	6.0	28.3	1.35
1680394	852	6.0	28.8	1.18
1680394	842	6.0	29.2	1.43
1680394	831	6.0	23.2	1.05
1680394	828	6.0	27.1	1.82
1680394	835	6.0	26.8	1.70
1680394	833	6.0	29.1	1.74
Average	837	6.0	27.5	1.47
Std. Dev.	8	0.0	2.1	0.30
L. Limit (95%)	829	6.0	25.6	1.19
U. Limit (95%)	844	6.0	29.4	1.74
1680395	838	6.0	25.7	1.36
1680395	838	6.0	28.6	1.30
1680395	836	6.0	28.2	1.20
1680395	832	6.0	27.9	1.54
1680395	837	6.0	28.6	1.36
1680395	827	6.0	26.4	1.20
1680395	837	6.0	25.8	1.86
Average	835	6.0	27.3	1.40
Std. Dev.	4	0.0	1.3	0.23
L. Limit (95%)	831	6.0	26.1	1.19
U. Limit (95%)	839	6.0	28.5	1.62
1680396	836	6.0	26.1	1.23
1680396	840	6.0	26.7	1.15
1680396	847	6.0	27.5	1.21
1680396	848	6.0	26.9	1.10
1680396	835	6.0	29.1	1.38
1680396	842	6.0	25.5	1.22
1680396	834	6.0	28.8	1.31
Average	840	6.0	27.2	1.23
Std. Dev.	6	0.0	1.3	0.09
L. Limit (95%)	835	6.0	26.0	1.14
U. Limit (95%)	845	6.0	28.5	1.32

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Table 8g: Yields of Ammonia in Mainstream Tobacco Smoke: 'Intense' Conditions*

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	Ammonia [µg/cig]
1680394	839	12.0	53.7	12.4
1680394	835	12.0	53.5	11.9
1680394	834	12.0	55.5	12.1
1680394	826	12.0	52.4	12.8
1680394	839	12.0	55.2	15.7
1680394	839	12.0	56.9	12.1
1680394	820	12.0	52.2	10.5
Average	833	12.0	54.2	12.5
Std. Dev.	7	0.0	1.7	1.6
L. Limit (95%)	826	12.0	52.6	11.0
U. Limit (95%)	840	12.0	55.8	14.0
1680395	828	12.0	54.6	11.3
1680395	822	12.0	55.5	10.3
1680395	840	12.0	58.7	12.3
1680395	835	12.0	56.0	10.8
1680395	822	12.0	56.7	12.7
1680395	816	12.0	56.5	13.0
1680395	822	12.0	56.0	12.4
Average	826	12.0	56.3	11.8
Std. Dev.	8	0.0	1.3	1.0
L. Limit (95%)	819	12.0	55.1	10.9
U. Limit (95%)	834	12.0	57.5	12.8
1680396	832	12.0	55.8	11.0
1680396	839	12.0	55.4	11.9
1680396	844	12.0	56.5	11.5
1680396	845	12.0	55.9	10.6
1680396	844	12.0	55.1	9.96
1680396	845	12.0	58.8	11.8
1680396	833	12.0	53.7	9.93
Average	840	12.0	55.9	11.0
Std. Dev.	6	0.0	1.6	0.8
L. Limit (95%)	835	12.0	54.4	10.2
U. Limit (95%)	845	12.0	57.3	11.7

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Table 16a: Yields of Benzo(a)pyrene in Particulate Phase of Mainstream Tobacco Smoke: 'ISO' Conditions*

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	Benzo(a) pyrene [ng/cig]
1680394	848	6.0	28.1	< 0.354 but ≥ 0.106
1680394	837	6.0	29.0	< 0.354 but ≥ 0.106
1680394	843	6.0	26.8	< 0.354 but ≥ 0.106
1680394	837	6.0	28.1	< 0.354 but ≥ 0.106
1680394	845	6.0	28.8	< 0.354 but ≥ 0.106
1680394	838	6.0	27.2	< 0.354 but ≥ 0.106
1680394	836	6.0	28.7	< 0.354 but ≥ 0.106
Average	841	6.0	28.1	**NQ**
Std. Dev.	5	0.0	0.8	**NQ**
L. Limit (95%)	836	6.0	27.3	N/A
U. Limit (95%)	845	6.0	28.9	N/A
1680395	835	6.0	28.9	< 0.354 but ≥ 0.106
1680395	829	6.0	28.2	< 0.354 but ≥ 0.106
1680395	828	6.0	29.1	< 0.354 but ≥ 0.106
1680395	826	6.0	27.1	< 0.354 but ≥ 0.106
1680395	821	6.0	27.6	< 0.354 but ≥ 0.106
1680395	832	6.0	29.5	< 0.354 but ≥ 0.106
1680395	842	6.0	29.2	< 0.354 but ≥ 0.106
Average	830	6.0	28.5	**NQ**
Std. Dev.	7	0.0	0.9	**NQ**
L. Limit (95%)	824	6.0	27.7	N/A
U. Limit (95%)	837	6.0	29.3	N/A
1680396	829	6.0	29.4	< 0.354 but ≥ 0.106
1680396	842	6.0	27.5	< 0.354 but ≥ 0.106
1680396	845	6.0	26.1	< 0.354 but ≥ 0.106
1680396	849	6.0	29.4	0.368
1680396	842	6.0	28.5	< 0.354 but ≥ 0.106
1680396	825	6.0	28.6	< 0.354 but ≥ 0.106
1680396	845	6.0	30.2	< 0.354 but ≥ 0.106
Average	840	6.0	28.5	**NQ**
Std. Dev.	9	0.0	1.3	**NQ**
L. Limit (95%)	831	6.0	27.3	N/A
U. Limit (95%)	848	6.0	29.8	N/A

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
NQ: Below the Limit of Quantification
N/A: Not Applicable

Table 16a: Yields of Benzo(a)pyrene in Particulate Phase of Laboratory Reagent Blank: 'ISO' Conditions*

Sample ID	Benzo(a) pyrene [ng/cig]
LRB	< 0.106
Average	**BDL**
Std. Dev.	**BDL**
L. Limit (95%)	ND
U. Limit (95%)	ND

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
BDL: Below the Limit of Detection
ND: Not Defined

Table 16g: Yields of Benzo(a)pyrene in Particulate Phase of Mainstream Tobacco Smoke: 'Intense' Conditions*

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	Benzo(a) pyrene [ng/cig]
1680394	837	12.0	55.0	0.544
1680394	843	12.0	54.9	0.464
1680394	837	12.0	53.2	0.496
1680394	831	12.0	53.4	0.576
1680394	842	12.0	52.3	0.512
1680394	830	12.0	51.1	0.480
1680394	840	12.0	54.5	0.512
Average	837	12.0	53.5	0.512
Std. Dev.	5	0.0	1.4	0.038
L. Limit (95%)	832	12.0	52.2	0.477
U. Limit (95%)	842	12.0	54.8	0.547
1680395	812	12.0	52.8	0.624
1680395	825	12.0	55.1	0.560
1680395	838	12.0	56.3	0.608
1680395	820	12.0	55.0	0.496
1680395	809	12.0	54.5	0.608
1680395	816	12.0	56.3	0.608
1680395	814	12.0	56.2	0.592
Average	819	12.0	55.2	0.585
Std. Dev.	10	0.0	1.3	0.044
L. Limit (95%)	810	12.0	54.0	0.544
U. Limit (95%)	828	12.0	56.3	0.626
1680396	832	12.0	54.8	0.624
1680396	829	12.0	54.4	0.512
1680396	829	12.0	53.9	0.528
1680396	822	12.0	53.4	0.544
1680396	831	12.0	54.6	0.528
1680396	826	12.0	51.5	0.480
1680396	832	12.0	51.7	0.432
Average	829	12.0	53.5	0.521
Std. Dev.	4	0.0	1.4	0.059
L. Limit (95%)	825	12.0	52.2	0.467
U. Limit (95%)	832	12.0	54.8	0.576

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Table 16g: Yields of Benzo(a)pyrene in Particulate Phase of Laboratory Reagent Blank: 'Intense' Conditions*

Sample ID	Benzo(a) pyrene [ng/cig]
LRB	< 0.106
Average	**BDL**
Std. Dev.	**BDL**
L. Limit (95%)	ND
U. Limit (95%)	ND

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
BDL: Below the Limit of Detection
ND: Not Defined

Table 18a: **Yields of Selected Aromatic Amines in Mainstream Tobacco Smoke: 'ISO' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	1-amino-naphthalene [ng/cig]	2-amino-naphthalene [ng/cig]	4-amino-biphenyl [ng/cig]
1680394	830	6.0	26.3	< 0.027 but ≥ 0.008	< 0.012 but ≥ 0.004	0.005
1680394	831	6.0	28.0	< 0.027 but ≥ 0.008	< 0.012 but ≥ 0.004	< 0.005 but ≥ 0.001
1680394	832	6.0	27.9	0.053	0.043	0.011
1680394	828	6.0	25.0	< 0.027 but ≥ 0.008	< 0.012 but ≥ 0.004	< 0.005 but ≥ 0.001
1680394	833	6.0	27.2	0.029	0.017	0.006
1680394	827	6.0	27.3	0.036	0.031	0.006
1680394	831	6.0	27.3	0.064	0.043	0.007
Average	831	6.0	27.0	0.034	0.022	0.006
Std. Dev.	2	0.0	1.0	0.019	0.016	0.003
L. Limit (95%)	828	6.0	26.0	0.016	0.007	0.003
U. Limit (95%)	833	6.0	28.0	0.051	0.038	0.008
1680395	829	6.0	26.4	< 0.027 but ≥ 0.008	< 0.012 but ≥ 0.004	0.005
1680395	826	6.0	26.1	0.048	0.046	0.009
1680395	821	6.0	25.1	< 0.027 but ≥ 0.008	0.013	< 0.005 but ≥ 0.001
1680395	824	6.0	25.3	0.058	0.050	0.010
1680395	834	6.0	24.9	< 0.027 but ≥ 0.008	0.015	0.006
1680395	815	6.0	24.0	< 0.027 but ≥ 0.008	< 0.012 but ≥ 0.004	0.005
1680395	818	6.0	26.1	< 0.027 but ≥ 0.008	< 0.012 but ≥ 0.004	0.006
Average	824	6.0	25.4	0.028	0.021	0.006
Std. Dev.	6	0.0	0.8	0.017	0.019	0.002
L. Limit (95%)	818	6.0	24.6	0.012	0.004	0.004
U. Limit (95%)	830	6.0	26.2	0.044	0.038	0.009

Table 18a: **Yields of Selected Aromatic Amines in Mainstream Tobacco Smoke: 'ISO' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	1-amino-naphthalene [ng/cig]	2-amino-naphthalene [ng/cig]	4-amino-biphenyl [ng/cig]
1680396	831	6.0	25.1	< 0.027 but ≥ 0.008	< 0.012 but ≥ 0.004	< 0.005 but ≥ 0.001
1680396	826	6.0	27.4	< 0.027 but ≥ 0.008	< 0.012 but ≥ 0.004	0.005
1680396	829	6.0	26.4	< 0.027 but ≥ 0.008	< 0.012 but ≥ 0.004	0.005
1680396	832	6.0	25.3	< 0.027 but ≥ 0.008	< 0.012 but ≥ 0.004	0.006
1680396	836	6.0	26.8	< 0.008	< 0.012 but ≥ 0.004	0.007
1680396	827	6.0	27.4	< 0.027 but ≥ 0.008	< 0.012 but ≥ 0.004	< 0.005 but ≥ 0.001
1680396	843	6.0	28.0	0.033	0.020	0.006
Average	832	6.0	26.6	**NQ**	**NQ**	0.005
Std. Dev.	6	0.0	1.1	**NQ**	**NQ**	0.001
L. Limit (95%)	826	6.0	25.6	N/A	N/A	0.004
U. Limit (95%)	837	6.0	27.6	N/A	N/A	0.006

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
NQ: Below the Limit of Quantification
N/A: Not Applicable

Table 18a: Yields of Selected Aromatic Amines in Laboratory Reagent Blank: 'ISO' Conditions*

Sample ID	1-amino-naphthalene [ng/cig]	2-amino-naphthalene [ng/cig]	4-amino-biphenyl [ng/cig]
LRB	< 0.027 but ≥ 0.008	0.017	< 0.001
Average	**NQ**	0.017	**BDL**
Std. Dev.	**NQ**	ND	**BDL**
L. Limit (95%)	ND	ND	ND
U. Limit (95%)	ND	ND	ND

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
BDL: Below the Limit of Detection
NQ: Below the Limit of Quantification
ND: Not Defined

Table 18b: **Yields of Selected Aromatic Amines in Mainstream Tobacco Smoke: 'Intense' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	1-amino-naphthalene [ng/cig]	2-amino-naphthalene [ng/cig]	4-amino-biphenyl [ng/cig]
1680394	841	12.0	57.9	0.051	0.029	0.010
1680394	835	12.0	56.7	0.049	0.024	0.008
1680394	835	12.0	56.5	< 0.027 but ≥ 0.008	0.020	0.007
1680394	831	12.0	56.0	0.055	0.036	0.012
1680394	837	12.0	54.8	0.035	0.027	0.012
1680394	841	12.0	54.4	0.036	0.020	0.009
1680394	830	12.0	55.9	0.037	0.019	0.010
Average	835	12.0	56.0	0.040	0.025	0.010
Std. Dev.	4	0.0	1.2	0.013	0.006	0.002
L. Limit (95%)	831	12.0	54.9	0.028	0.019	0.008
U. Limit (95%)	839	12.0	57.1	0.052	0.031	0.011
1680395	818	12.0	53.8	0.046	0.018	0.010
1680395	820	12.0	55.3	0.039	0.014	0.008
1680395	823	12.0	54.9	0.034	0.016	0.008
1680395	824	12.0	55.6	0.044	0.028	0.010
1680395	827	12.0	NR	< 0.027 but ≥ 0.008	0.013	0.006
1680395	824	12.0	55.9	0.032	< 0.012 but ≥ 0.004	0.009
1680395	822	12.0	55.4	0.038	0.021	0.012
Average	823	12.0	55.2	0.036	0.017	0.009
Std. Dev.	3	0.0	0.7	0.009	0.006	0.002
L. Limit (95%)	820	12.0	54.4	0.027	0.011	0.007
U. Limit (95%)	826	12.0	55.9	0.045	0.023	0.011

Table 18b: **Yields of Selected Aromatic Amines in Mainstream Tobacco Smoke: 'Intense' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	1-amino-naphthalene [ng/cig]	2-amino-naphthalene [ng/cig]	4-amino-biphenyl [ng/cig]
1680396	837	12.0	55.1	0.038	0.016	0.006
1680396	836	12.0	55.0	0.028	< 0.012 but ≥ 0.004	0.006
1680396	835	12.0	54.7	0.035	0.015	0.009
1680396	844	12.0	55.3	0.044	0.025	0.010
1680396	838	12.0	53.9	0.038	0.024	0.006
1680396	832	12.0	54.1	0.042	0.022	0.007
1680396	843	12.0	55.0	0.028	< 0.012 but ≥ 0.004	0.009
Average	838	12.0	54.7	0.036	0.017	0.008
Std. Dev.	4	0.0	0.5	0.006	0.007	0.002
L. Limit (95%)	834	12.0	54.2	0.030	0.010	0.006
U. Limit (95%)	842	12.0	55.2	0.042	0.023	0.009

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
NR: Not Reported

Table 18b: Yields of Selected Aromatic Amines in Laboratory Reagent Blank: 'Intense' Conditions*

Sample ID	1-amino-naphthalene [ng/cig]	2-amino-naphthalene [ng/cig]	4-amino-biphenyl [ng/cig]
LRB	< 0.027 but ≥ 0.008	0.014	< 0.001
Average	**NQ**	0.014	**BDL**
Std. Dev.	**NQ**	ND	**BDL**
L. Limit (95%)	ND	ND	ND
U. Limit (95%)	ND	ND	ND

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
BDL: Below the Limit of Detection
NQ: Below the Limit of Quantification
ND: Not Defined

Table 19a: **Yields of Various Volatile Organics in Mainstream Tobacco Smoke: 'ISO' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	Gas Phase				
				1,3-butadiene [µg/cig]	Isoprene [µg/cig]	Acrylonitrile [µg/cig]	Benzene [µg/cig]	Toluene [µg/cig]
1680394	830	6.0	26.3	0.125	1.22	0.117	0.489	1.47
1680394	831	6.0	28.0	0.126	1.14	< 0.107 but ≥ 0.032	0.328	0.994
1680394	832	6.0	27.9	0.119	1.04	< 0.107 but ≥ 0.032	0.249	0.814
1680394	828	6.0	25.0	0.127	0.960	< 0.107 but ≥ 0.032	0.194	0.603
1680394	833	6.0	27.2	0.119	0.860	< 0.107 but ≥ 0.032	0.190	0.535
1680394	827	6.0	27.3	0.117	1.08	< 0.107 but ≥ 0.032	0.272	0.917
1680394	831	6.0	27.3	0.116	1.14	< 0.107 but ≥ 0.032	0.336	1.12
Average	831	6.0	27.0	0.121	1.06	**NQ**	0.294	0.921
Std. Dev.	2	0.0	1.0	0.005	0.12	**NQ**	0.104	0.318
L. Limit (95%)	828	6.0	26.0	0.117	0.95	N/A	0.198	0.628
U. Limit (95%)	833	6.0	28.0	0.125	1.18	N/A	0.390	1.215
1680395	829	6.0	26.4	0.126	1.16	0.123	0.468	1.29
1680395	821	6.0	25.1	0.124	1.08	0.117	0.448	1.23
1680395	829	6.0	26.5	0.111	0.880	< 0.107 but ≥ 0.032	0.202	0.628
1680395	817	6.0	27.6	0.117	1.00	< 0.107 but ≥ 0.032	0.221	0.702
1680395	815	6.0	24.0	0.099	0.760	< 0.107 but ≥ 0.032	0.182	0.558
1680395	818	6.0	26.1	0.098	0.840	< 0.107 but ≥ 0.032	0.186	0.515
1680395	819	6.0	28.9	0.131	1.26	< 0.107 but ≥ 0.032	0.299	1.000
Average	821	6.0	26.3	0.115	0.997	**NQ**	0.287	0.845
Std. Dev.	6	0.0	1.6	0.013	0.181	**NQ**	0.124	0.322
L. Limit (95%)	816	6.0	24.9	0.103	0.830	N/A	0.172	0.547
U. Limit (95%)	826	6.0	27.8	0.127	1.165	N/A	0.401	1.144

Table 19a: **Yields of Various Volatile Organics in Mainstream Tobacco Smoke: 'ISO' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	Gas Phase				
				1,3-butadiene [µg/cig]	Isoprene [µg/cig]	Acrylonitrile [µg/cig]	Benzene [µg/cig]	Toluene [µg/cig]
1680396	831	6.0	25.1	0.099	0.960	< 0.107 but ≥ 0.032	0.334	1.12
1680396	826	6.0	27.4	0.096	0.880	< 0.107 but ≥ 0.032	0.197	0.569
1680396	829	6.0	26.4	0.109	0.840	< 0.107 but ≥ 0.032	0.188	0.478
1680396	836	6.0	26.8	0.110	0.880	< 0.107 but ≥ 0.032	0.197	0.526
1680396	827	6.0	27.4	0.113	0.960	< 0.107 but ≥ 0.032	0.195	0.534
1680396	843	6.0	28.0	0.119	0.980	< 0.107 but ≥ 0.032	0.244	0.685
1680396	835	6.0	26.2	0.123	1.00	< 0.107 but ≥ 0.032	0.252	0.694
Average	832	6.0	26.8	0.110	0.929	**NQ**	0.230	0.658
Std. Dev.	6	0.0	1.0	0.010	0.061	**NQ**	0.053	0.219
L. Limit (95%)	827	6.0	25.9	0.101	0.872	N/A	0.181	0.455
U. Limit (95%)	838	6.0	27.6	0.119	0.985	N/A	0.279	0.861

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
NQ: Below the Limit of Quantification
N/A: Not Applicable

Table 19a: Yields of Various Volatile Organics in Laboratory Reagent Blank: 'ISO' Conditions*

Sample ID	Gas Phase				
	1,3-butadiene [µg/cig]	Isoprene [µg/cig]	Acrylonitrile [µg/cig]	Benzene [µg/cig]	Toluene [µg/cig]
LRB	< 0.029	< 0.041	< 0.032	< 0.017	< 0.061
LRB	< 0.029	< 0.041	< 0.032	< 0.017	< 0.061
Average	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**
Std. Dev.	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**
L. Limit (95%)	ND	ND	ND	ND	ND
U. Limit (95%)	ND	ND	ND	ND	ND

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
BDL: Below the Limit of Detection
ND: Not Defined

Table 19b: **Yields of Various Volatile Organics in Mainstream Tobacco Smoke: 'Intense' Conditions***

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	Gas Phase				
				1,3-butadiene [µg/cig]	Isoprene [µg/cig]	Acrylonitrile [µg/cig]	Benzene [µg/cig]	Toluene [µg/cig]
1680394	841	12.0	57.9	0.221	1.64	0.116	0.563	1.56
1680394	835	12.0	56.7	0.255	2.08	0.149	0.646	1.77
1680394	831	12.0	56.0	0.195	1.46	0.137	0.465	1.49
1680394	835	12.0	56.5	0.249	1.64	0.123	0.464	1.18
1680394	831	12.0	56.0	0.264	1.84	0.132	0.510	1.30
1680394	837	12.0	54.8	0.230	1.76	< 0.107 but ≥ 0.032	0.493	1.25
1680394	841	12.0	54.4	0.193	1.38	0.118	0.419	1.13
Average	836	12.0	56.1	0.230	1.69	0.121	0.509	1.38
Std. Dev.	4	0.0	1.2	0.028	0.24	0.025	0.075	0.23
L. Limit (95%)	832	12.0	54.9	0.203	1.47	0.097	0.439	1.17
U. Limit (95%)	839	12.0	57.2	0.256	1.90	0.144	0.578	1.60
1680395	816	12.0	51.7	0.167	1.08	0.135	0.428	1.28
1680395	818	12.0	53.8	0.228	1.52	0.125	0.459	1.25
1680395	820	12.0	55.3	0.223	1.64	0.142	0.526	1.38
1680395	823	12.0	54.9	0.230	1.46	0.131	0.423	1.10
1680395	824	12.0	55.6	0.214	1.42	< 0.107 but ≥ 0.032	0.451	1.27
1680395	824	12.0	55.9	0.242	1.78	0.130	0.554	1.53
1680395	822	12.0	55.4	0.219	1.62	0.163	0.487	1.37
Average	821	12.0	54.7	0.218	1.50	0.128	0.476	1.31
Std. Dev.	3	0.0	1.5	0.024	0.22	0.029	0.050	0.13
L. Limit (95%)	818	12.0	53.3	0.195	1.30	0.101	0.430	1.19
U. Limit (95%)	824	12.0	56.0	0.240	1.71	0.154	0.521	1.44

Table 19b: **Yields of Various Volatile Organics in Mainstream Tobacco Smoke: 'Intense' Conditions***

Sample ID	Weight	Puff Count	MS TPM	Gas Phase				
				1,3-butadiene	Isoprene	Acrylonitrile	Benzene	Toluene
	[mg/cig]	[per cig]	[mg/cig]	[µg/cig]	[µg/cig]	[µg/cig]	[µg/cig]	[µg/cig]
1680396	837	12.0	55.1	0.216	1.54	0.111	0.510	1.63
1680396	836	12.0	55.0	0.221	1.68	0.160	0.552	1.68
1680396	835	12.0	54.7	0.275	2.04	0.157	0.628	1.99
1680396	836	12.0	53.0	0.217	1.52	0.154	0.475	1.50
1680396	844	12.0	55.3	0.277	1.92	0.162	0.570	1.69
1680396	838	12.0	53.9	0.205	1.54	0.107	0.449	1.21
1680396	832	12.0	54.1	0.248	1.52	0.124	0.442	1.18
Average	837	12.0	54.4	0.237	1.68	0.139	0.518	1.55
Std. Dev.	3	0.0	0.8	0.030	0.22	0.025	0.069	0.29
L. Limit (95%)	834	12.0	53.7	0.210	1.48	0.117	0.455	1.29
U. Limit (95%)	840	12.0	55.2	0.265	1.88	0.162	0.582	1.82

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Table 19b: Yields of Various Volatile Organics in Laboratory Reagent Blank: 'Intense' Conditions*

Sample ID	Gas Phase				
	1,3-butadiene [µg/cig]	Isoprene [µg/cig]	Acrylonitrile [µg/cig]	Benzene [µg/cig]	Toluene [µg/cig]
LRB	< 0.029	< 0.041	< 0.032	< 0.017	< 0.061
LRB	< 0.029	< 0.041	< 0.032	< 0.017	< 0.061
Average	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**
Std. Dev.	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**
L. Limit (95%)	ND	ND	ND	ND	ND
U. Limit (95%)	ND	ND	ND	ND	ND

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
BDL: Below the Limit of Detection
ND: Not Defined

Yields of Tobacco Specific Nitrosamines in Mainstream Tobacco Smoke (LC-MS/MS Method): 'ISO' Conditions*

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	NNN [ng/cig]	NNK [ng/cig]
1680394	842	6.0	30.6	3.96	2.92
1680394	843	6.0	30.9	3.10	2.70
1680394	832	6.0	30.3	3.58	3.48
1680394	844	6.0	30.1	3.03	3.08
1680394	847	6.0	29.4	3.82	2.96
1680394	852	6.0	29.1	2.57	2.36
1680394	839	6.0	28.2	2.27	2.33
Average	843	6.0	29.8	3.19	2.83
Std. Dev.	6	0.0	1.0	0.63	0.41
L. Limit (95%)	837	6.0	28.9	2.60	2.46
U. Limit (95%)	848	6.0	30.7	3.78	3.21
1680395	836	6.0	30.2	3.29	3.28
1680395	847	6.0	29.9	3.86	3.55
1680395	835	6.0	26.4	3.62	2.86
1680395	844	6.0	28.7	2.90	2.82
1680395	843	6.0	29.8	3.23	2.81
1680395	825	6.0	29.3	3.47	2.97
1680395	838	6.0	32.0	3.77	3.29
Average	838	6.0	29.5	3.45	3.08
Std. Dev.	7	0.0	1.7	0.34	0.29
L. Limit (95%)	832	6.0	27.9	3.14	2.81
U. Limit (95%)	845	6.0	31.1	3.76	3.35
1680396	827	6.0	28.4	2.89	2.60
1680396	828	6.0	30.0	3.40	3.20
1680396	841	6.0	30.6	3.52	2.94
1680396	838	6.0	30.2	3.27	2.73
1680396	831	6.0	28.7	3.36	3.07
1680396	825	6.0	25.6	2.98	2.51
1680396	842	6.0	33.5	3.46	3.09
Average	833	6.0	29.6	3.27	2.88
Std. Dev.	7	0.0	2.4	0.24	0.27
L. Limit (95%)	827	6.0	27.3	3.04	2.63
U. Limit (95%)	840	6.0	31.8	3.49	3.12

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Yields of Tobacco Specific Nitrosamines in Laboratory Reagent Blank (LC-MS/MS Method): 'ISO' Conditions*

Sample ID	NNN [ng/cig]	NNK [ng/cig]
LRB	< 0.098	< 0.151
Average	**BDL**	**BDL**
Std. Dev.	**BDL**	**BDL**
L. Limit (95%)	ND	ND
U. Limit (95%)	ND	ND

* puff volume, 35mL; interval, 60 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
BDL: Below the Limit of Detection
ND: Not Defined

Yields of Tobacco Specific Nitrosamines in Mainstream Tobacco Smoke (LC-MS/MS Method): 'Intense' Conditions*

Sample ID	Weight [mg/cig]	Puff Count [per cig]	MS TPM [mg/cig]	NNN [ng/cig]	NNK [ng/cig]
1680394	828	12.0	54.8	8.12	7.56
1680394	836	12.0	54.8	8.36	6.48
1680394	838	12.0	52.4	7.56	5.92
1680394	841	12.0	53.9	7.92	6.00
1680394	837	12.0	55.4	8.04	6.88
1680394	836	12.0	55.2	8.32	6.56
1680394	841	12.0	50.9	7.36	6.20
Average	837	12.0	53.9	7.95	6.51
Std. Dev.	4	0.0	1.7	0.37	0.57
L. Limit (95%)	833	12.0	52.3	7.61	5.99
U. Limit (95%)	840	12.0	55.4	8.30	7.04
1680395	835	12.0	55.0	8.24	7.24
1680395	838	12.0	54.1	8.72	8.32
1680395	839	12.0	55.7	9.56	7.52
1680395	840	12.0	54.5	9.24	7.24
1680395	841	12.0	55.3	8.16	7.16
1680395	831	12.0	55.3	9.28	8.08
1680395	835	12.0	57.5	8.88	8.04
Average	837	12.0	55.3	8.87	7.66
Std. Dev.	4	0.0	1.1	0.53	0.48
L. Limit (95%)	834	12.0	54.3	8.38	7.21
U. Limit (95%)	840	12.0	56.4	9.36	8.10
1680396	841	12.0	52.3	7.20	6.04
1680396	835	12.0	53.5	7.00	5.60
1680396	833	12.0	55.4	8.24	6.44
1680396	823	12.0	53.9	8.20	7.00
1680396	831	12.0	54.9	7.20	6.60
1680396	836	12.0	57.3	8.92	6.80
1680396	835	12.0	53.4	7.64	5.88
Average	833	12.0	54.4	7.77	6.34
Std. Dev.	5	0.0	1.6	0.71	0.51
L. Limit (95%)	828	12.0	52.9	7.12	5.86
U. Limit (95%)	838	12.0	55.9	8.42	6.81

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Yields of Tobacco Specific Nitrosamines in Laboratory Reagent Blank (LC-MS/MS Method): 'Intense' Conditions*

Sample ID	NNN [ng/cig]	NNK [ng/cig]
LRB	< 0.197	< 0.301
Average	**BDL**	**BDL**
Std. Dev.	**BDL**	**BDL**
L. Limit (95%)	ND	ND
U. Limit (95%)	ND	ND

* puff volume, 55mL; interval, 30 sec; duration, 2 sec; vent blocking, 0%
See text for additional details.

Glossary of Abbreviations
BDL: Below the Limit of Detection
ND: Not Defined

12 APPENDIX B: "RAW" DATA AND SUMMARY STATISTICS: PROCESSED TOBACCO

Labstat Sample ID	SMP Description	Qty/Type Received	Type of Product	Type of Analysis
1680397	SMP060615	1/box	sticks	tobacco constituents
1680398	SMP060616	1/box	sticks	tobacco constituents
1680399	SMP060617	1/box	sticks	tobacco constituents

Limits of Detection (LOD) and Limits of Quantification (LOQ) Determined for Selected Constituents in Processed Tobacco

Health Canada Method	Analyte	Units	Processed Tobacco	
			LOD	LOQ
	Alkaloids			
T-301	Nicotine	µg/g (dry wt)	75.0	250
	Ammonia			
T-302	Ammonia	µg/g (dry wt)	18.0	60.0
	Toxic Trace Metals			
T-306*	Cadmium	ng/g (dry wt)	8.23	27.4
T-306*	Arsenic	ng/g (dry wt)	7.01	23.4

Abbreviations: BDL, below detection limit; NQ, below quantitation limit; N/A, not applicable
Date of last review: May 30, 2012

NOTE: The above limits referred to samples processed as required by the referenced Health Canada Method (ie. either "as received" or "dried"). Corrections for the moisture content, determined independently, must be applied where applicable in order to convert the "as received" limits to limits expressed on a "dry weight" basis.

*NOTE: The LOD and LOQ are based on the lowest standard concentration used for calibration of the instruments as referenced in the Health Canada Method.

LOD Definition: The limit of detection (LOD) for a particular analyte is a statistically defined decision point that, with a specified probability, measured results falling at or above this point are interpreted to indicate an analyte concentration greater than zero within the sample.

LOQ Definition: The limit of quantification for a particular analyte is another statistically defined decision point that results falling at or above this point can be assigned a statistically significant numerical value with an associated level of precision. Values falling between the LOD and LOQ are interpreted as a positive but not quantifiable result for the analyte in question.

*Methods have been modified from the standard methods.

Limits of Detection (LOD) and Limits of Quantification (LOQ) Determined for Selected Constituents in Processed Tobacco

Labstat Method	Analyte	Units	Processed Tobacco	
			LOD	LOQ
	Tobacco Specific Nitrosamines (LC-MS/MS)			
TWT-00333	Nitrosonornicotine (NNN)	ng/g (as rec'd)	0.985	3.28
TWT-00333	4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	ng/g (as rec'd)	1.51	5.02

Abbreviations: BDL, below detection limit; NQ, below quantitation limit; N/A, not applicable
Date of last review: August 12, 2013

NOTE: The above limits referred to samples processed as required by the referenced Health Canada Method (i.e. either "as received" or "dried"). Corrections for the moisture content, determined independently, must be applied where applicable in order to convert the "as-received" limits to limits expressed on a "dry weight" basis.

**NOTE: The LOD and LOQ are based on the lowest standard concentration used for calibration of the instruments as referenced in the Health Canada Method.

LOD Definition: The limit of detection (LOD) for a particular analyte is a statistically defined decision point that, with a specified probability, measured results falling at or above this point are interpreted to indicate an analyte concentration greater than zero within the sample.

LOQ Definition: The limit of quantification for a particular analyte is another statistically defined decision point that results falling at or above this point can be assigned a statistically significant numerical value with an associated level of precision. Values falling between the LOD and LOQ are interpreted as a positive but not quantifiable result for the analyte in question.

Weight of Tobacco in Bidi, Cigarette, Cigar, Tobacco Stick or Kretek Samples (milligrams of tobacco per unit 'as received')*

	Sample ID		
Obs.	1680397	1680398	1680399
1	312.7	275.9	286.7
2	307.8	305.5	289.5
3	316.6	278.5	300.9
4	294.3	290.8	283.7
5	310.0	286.6	293.9
6	304.6	274.5	300.1
7	322.9	298.3	305.6
8	316.4	291.3	285.2
9	299.9	311.5	302.5
10	293.4	289.4	314.2
Average	307.9	290.2	296.2
Std. Dev	9.8	12.3	10.0
L. Limit (95%)	300.8	281.4	289.0
U. Limit (95%)	314.9	299.0	303.4

Weight of Tobacco in Bidi, Cigarette, Cigar, Tobacco Stick or Kretek Samples (milligrams of tobacco per unit 'dry weight')**

Sample ID	Tobacco Weight (mg/unit)	Dry Matter (%)	Tobacco Weight (mg/unit) 'dry weight'
1680397	307.9	85.2	262.4
1680398	290.2	85.0	246.6
1680399	296.2	85.1	252.1

* as required in part 3, section 14 (2)c of the Canadian Tobacco Reporting Regulations

** as required in part 2, section 12 (6) and 12 (7)ci. of the Canadian Tobacco Reporting Regulations

Tobacco Constituent	Matrix Code / Sample ID / Unit	WT 1680397 Average	WT 1680397 Std. Dev.	WT 1680397 L. Limit (95%)	WT 1680397 U. Limit (95%)	WT 1680398 Average	WT 1680398 Std. Dev.	WT 1680398 L. Limit (95%)	WT 1680398 U. Limit (95%)
Alkaloids									
Nicotine	[µg/g]	18246	320	17950	18543	18564	274	18310	18817
Ammonia									
Ammonia	[µg/g]	429	9	421	437	431	21	412	450
Toxic Trace Metals									
Cadmium	[ng/g]	603	6	598	609	604	7	598	611
Arsenic	[ng/g]	154	4	150	158	160	7	154	166
Tobacco Specific Nitrosamines (LC-MS/MS)									
Nitrosonornicotine (NNN)	[ng/g]	364	26	341	388	335	46	292	378
4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	[ng/g]	232	12	222	243	222	13	211	234
Water									
Dry Matter	(%)	85.2	0.3	84.9	85.5	85.0	0.3	84.7	85.3
Moisture	(%)	14.8	0.3	14.5	15.1	15.0	0.3	14.7	15.3

Glossary of Abbreviations

L. Limit (95%): lower limit of the 95% confidence interval

U. Limit (95%): upper limit of the 95% confidence interval

Tobacco Constituent	Matrix Code Sample ID Unit	WT 1680399 Average	WT 1680399 Std. Dev.	WT 1680399 L. Limit (95%)	WT 1680399 U. Limit (95%)
Alkaloids					
Nicotine	[µg/g]	18791	406	18416	19167
Ammonia					
Ammonia	[µg/g]	417	5	412	421
Toxic Trace Metals					
Cadmium	[ng/g]	590	9	581	599
Arsenic	[ng/g]	172	6	166	177
Tobacco Specific Nitrosamines (LC-MS/MS)					
Nitrosonornicotine (NNN)	[ng/g]	316	51	269	364
4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	[ng/g]	197	9	188	206
Water					
Dry Matter	(%)	85.1	0.3	84.8	85.4
Moisture	(%)	14.9	0.3	14.6	15.2

Glossary of Abbreviations

L. Limit (95%): lower limit of the 95% confidence interval

U. Limit (95%): upper limit of the 95% confidence interval

Tobacco Constituent	Matrix Code Sample ID Unit	WT 1680397 Average	WT 1680397 Std. Dev.	WT 1680397 L. Limit (95%)	WT 1680397 U. Limit (95%)	WT 1680398 Average	WT 1680398 Std. Dev.	WT 1680398 L. Limit (95%)	WT 1680398 U. Limit (95%)
Alkaloids									
Nicotine	[µg/unit]	4787	84	4709	4865	4578	68	4516	4641
Ammonia									
Ammonia	[µg/unit]	113	2	110	115	106	5	102	111
Toxic Trace Metals									
Cadmium	[ng/unit]	158	2	157	160	149	2	147	151
Arsenic	[ng/unit]	40.5	1.1	39.5	41.5	39.5	1.6	38.0	41.0
Tobacco Specific Nitrosamines (LC-MS/MS)									
Nitrosonornicotine (NNN)	[ng/unit]	95.6	6.7	89.4	102	82.6	11.4	72.1	93.1
4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	[ng/unit]	61.0	3.1	58.1	63.8	54.8	3.2	51.9	57.8

Glossary of Abbreviations
L. Limit (95%): lower limit of the 95% confidence interval
U. Limit (95%): upper limit of the 95% confidence interval
[/unit]: as required in part 2, section 12 (5) of the Canadian Tobacco Reporting Regulations

Tobacco Constituent	Matrix Code Sample ID Unit	WT 1680399 Average	WT 1680399 Std. Dev.	WT 1680399 L. Limit (95%)	WT 1680399 U. Limit (95%)
Alkaloids					
Nicotine	[µg/unit]	4737	102	4642	4832
Ammonia					
Ammonia	[µg/unit]	105	1	104	106
Toxic Trace Metals					
Cadmium	[ng/unit]	149	2	147	151
Arsenic	[ng/unit]	43.2	1.4	41.9	44.6
Tobacco Specific Nitrosamines (LC-MS/MS)					
Nitrosonornicotine (NNN)	[ng/unit]	79.7	12.9	67.8	91.7
4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	[ng/unit]	49.7	2.4	47.5	51.8

Glossary of Abbreviations
L. Limit (95%): lower limit of the 95% confidence interval
U. Limit (95%): upper limit of the 95% confidence interval
[/unit]: as required in part 2, section 12 (5) of the Canadian Tobacco Reporting Regulations

FILLER REPORT WORKSHEET (1680397)

HPHC Name	CAS Code	FDA UNII Code	Number of Replicate Measurements	Test Start Date	Test End Date	Method of Extraction
Ammonia	7664-41-7	5138Q19F1X	7	08/04/2016	15/04/2016	Health Canada Method T-302; Extract with 0.025N H2SO4, 60 min.
Arsenic	7440-38-2	N712M78A8G	7	08/04/2016	13/04/2016	Health Canada Method T-306; nitric acid microwave digestion; 230°C, 40bar.
Cadmium	7440-43-9	00BH33GNGH	7	08/04/2016	13/04/2016	Health Canada Method T-306; nitric acid microwave digestion; 230°C, 40bar.
Nicotine (total)	54-11-5	6M3C89ZY6R	7	08/04/2016	14/04/2016	Health Canada Method T-306; methanolic KOH, sonicate 3 hours + shake 0.5 hours
4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	7S395EDO61	7	11/04/2016	13/04/2016	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.
N-Nitrosonornicotine (NNN)	16543-55-8	X656TZ86DX	7	11/04/2016	13/04/2016	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.

HPHC Name	Method of Separation	If "Other" Method of Separation, Specify	Method of Detection	If "Other" Method of Detection, Specify	Mean Quantity of HPHC per Cigarette	Variance of Mean HPHC Quantity	Type of Variance
Ammonia	IC	N/A	other	CD: Suppressed Conductivity Detection	112.565	2.264	Standard Deviation
Arsenic	N/A	Inductively Coupled Argon Plasma	MSD	Not Applicable	40.470	1.065	Standard Deviation
Cadmium	N/A	Inductively Coupled Argon Plasma	MSD	Not Applicable	158.252	1.566	Standard Deviation
Nicotine (total)	GC	N/A	NPD	Not Applicable	4.787	0.084	Standard Deviation
4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	HPLC	N/A	MSMS	Not Applicable	60.988	3.092	Standard Deviation
N-Nitrosonornicotine (NNN)	HPLC	N/A	MSMS	Not Applicable	95.608	6.745	Standard Deviation

HPHC Name	Unit of Measurement - Mean & Variance	If "Other" Unit of Measurement Mean & Variance, Specify
Ammonia	[µg/unit]	Not Applicable
Arsenic	[ng/unit]	Not Applicable
Cadmium	[ng/unit]	Not Applicable
Nicotine (total)	mg/unit	Not Applicable
4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	[ng/unit]	Not Applicable
N-Nitrosonornicotine (NNN)	[ng/unit]	Not Applicable

FILLER REPORT WORKSHEET (1680398)

HPHC Name	CAS Code	FDA UNII Code	Number of Replicate Measurements	Test Start Date	Test End Date	Method of Extraction
Ammonia	7664-41-7	5138Q19F1X	7	08/04/2016	15/04/2016	Health Canada Method T-302; Extract with 0.025N H2SO4, 60 min.
Arsenic	7440-38-2	N712M78A8G	7	08/04/2016	13/04/2016	Health Canada Method T-306; nitric acid microwave digestion; 230°C, 40bar.
Cadmium	7440-43-9	00BH33GNGH	7	08/04/2016	13/04/2016	Health Canada Method T-306; nitric acid microwave digestion; 230°C, 40bar.
Nicotine (total)	54-11-5	6M3C89ZY6R	7	08/04/2016	14/04/2016	Health Canada Method T-306; methanolic KOH, sonicate 3 hours + shake 0.5 hours
4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	7S395EDO61	7	11/04/2016	13/04/2016	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.
N-Nitrosonornicotine (NNN)	16543-55-8	X656TZ86DX	7	11/04/2016	13/04/2016	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.

HPHC Name	Method of Separation	If "Other" Method of Separation, Specify	Method of Detection	If "Other" Method of Detection, Specify	Mean Quantity of HPHC per Cigarette	Variance of Mean HPHC Quantity	Type of Variance
Ammonia	IC	N/A	other	CD: Suppressed Conductivity Detection	106.291	5.143	Standard Deviation
Arsenic	N/A	Inductively Coupled Argon Plasma	MSD	Not Applicable	39.499	1.605	Standard Deviation
Cadmium	N/A	Inductively Coupled Argon Plasma	MSD	Not Applicable	148.996	1.743	Standard Deviation
Nicotine (total)	GC	N/A	NPD	Not Applicable	4.578	0.068	Standard Deviation
4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	HPLC	N/A	MSMS	Not Applicable	54.840	3.153	Standard Deviation
N-Nitrosonornicotine (NNN)	HPLC	N/A	MSMS	Not Applicable	82.599	11.367	Standard Deviation

HPHC Name	Unit of Measurement - Mean & Variance	If "Other" Unit of Measurement Mean & Variance, Specify
Ammonia	[µg/unit]	Not Applicable
Arsenic	[ng/unit]	Not Applicable
Cadmium	[ng/unit]	Not Applicable
Nicotine (total)	mg/unit	Not Applicable
4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	[ng/unit]	Not Applicable
N-Nitrosonornicotine (NNN)	[ng/unit]	Not Applicable

FILLER REPORT WORKSHEET (1680399)

HPHC Name	CAS Code	FDA UNII Code	Number of Replicate Measurements	Test Start Date	Test End Date	Method of Extraction
Ammonia	7664-41-7	5138Q19F1X	7	08/04/2016	15/04/2016	Health Canada Method T-302; Extract with 0.025N H2SO4, 60 min.
Arsenic	7440-38-2	N712M78A8G	7	08/04/2016	13/04/2016	Health Canada Method T-306; nitric acid microwave digestion; 230°C, 40bar.
Cadmium	7440-43-9	00BH33GNGH	7	08/04/2016	13/04/2016	Health Canada Method T-306; nitric acid microwave digestion; 230°C, 40bar.
Nicotine (total)	54-11-5	6M3C89ZY6R	7	08/04/2016	14/04/2016	Health Canada Method T-306; methanolic KOH, sonicate 3 hours + shake 0.5 hours
4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	7S395EDO61	7	11/04/2016	13/04/2016	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.
N-Nitrosonornicotine (NNN)	16543-55-8	X656TZ86DX	7	11/04/2016	13/04/2016	NS235_Report.pdf Section 6.3.3.3; Extract in 100 mM ammonium acetate, 30 min.

HPHC Name	Method of Separation	If "Other" Method of Separation, Specify	Method of Detection	If "Other" Method of Detection, Specify	Mean Quantity of HPHC per Cigarette	Variance of Mean HPHC Quantity	Type of Variance
Ammonia	IC	N/A	other	CD: Suppressed Conductivity Detection	105.020	1.248	Standard Deviation
Arsenic	N/A	Inductively Coupled Argon Plasma	MSD	Not Applicable	43.249	1.414	Standard Deviation
Cadmium	N/A	Inductively Coupled Argon Plasma	MSD	Not Applicable	148.768	2.364	Standard Deviation
Nicotine (total)	GC	N/A	NPD	Not Applicable	4.737	0.102	Standard Deviation
4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	HPLC	N/A	MSMS	Not Applicable	49.660	2.356	Standard Deviation
N-Nitrosonornicotine (NNN)	HPLC	N/A	MSMS	Not Applicable	79.734	12.933	Standard Deviation

HPHC Name	Unit of Measurement - Mean & Variance	If "Other" Unit of Measurement Mean & Variance, Specify
Ammonia	[µg/unit]	Not Applicable
Arsenic	[ng/unit]	Not Applicable
Cadmium	[ng/unit]	Not Applicable
Nicotine (total)	mg/unit	Not Applicable
4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	[ng/unit]	Not Applicable
N-Nitrosonornicotine (NNN)	[ng/unit]	Not Applicable

Table 1: Nicotine Contents of Processed Tobacco (per gram 'Dry Weight' Basis)

Sample ID	Nicotine [µg/g]
1680397	18063
1680397	17892
1680397	18710
1680397	17954
1680397	18265
1680397	18203
1680397	18638
Average	18246
Std. Dev.	320
L. Limit (95%)	17950
U. Limit (95%)	18543
1680398	18731
1680398	18627
1680398	18565
1680398	18780
1680398	18600
1680398	18676
1680398	17966
Average	18564
Std. Dev.	274
L. Limit (95%)	18310
U. Limit (95%)	18817
1680399	18691
1680399	18805
1680399	18422
1680399	18659
1680399	19663
1680399	18766
1680399	18535
Average	18791
Std. Dev.	406
L. Limit (95%)	18416
U. Limit (95%)	19167

Table 2: Ammonia Content of Processed Tobacco (per gram 'Dry Weight' Basis)

Sample ID	Ammonia [µg/g]
1680397	441
1680397	426
1680397	418
1680397	419
1680397	430
1680397	433
1680397	436
Average	429
Std. Dev.	9
L. Limit (95%)	421
U. Limit (95%)	437
1680398	421
1680398	431
1680398	417
1680398	477
1680398	420
1680398	424
1680398	427
Average	431
Std. Dev.	21
L. Limit (95%)	412
U. Limit (95%)	450
1680399	425
1680399	416
1680399	410
1680399	420
1680399	417
1680399	413
1680399	416
Average	417
Std. Dev.	5
L. Limit (95%)	412
U. Limit (95%)	421

Table 4: Toxic Trace Metals Content of Processed Tobacco (per gram 'Dry Weight' Basis)

Sample ID	Cd [ng/g]	As [ng/g]
1680397	606	150
1680397	599	152
1680397	606	153
1680397	611	152
1680397	607	155
1680397	600	162
1680397	593	156
Average	603	154
Std. Dev.	6	4
L. Limit (95%)	598	150
U. Limit (95%)	609	158
1680398	611	166
1680398	605	156
1680398	613	172
1680398	605	155
1680398	604	158
1680398	593	160
1680398	597	155
Average	604	160
Std. Dev.	7	7
L. Limit (95%)	598	154
U. Limit (95%)	611	166
1680399	603	168
1680399	598	169
1680399	591	168
1680399	584	175
1680399	575	169
1680399	587	183
1680399	592	168
Average	590	172
Std. Dev.	9	6
L. Limit (95%)	581	166
U. Limit (95%)	599	177

TSNA Content of Processed Tobacco - LC-MS/MS Method
(per gram 'Dry Weight' Basis)

Sample ID	NNN [ng/g]	NNK [ng/g]
1680397	335	236
1680397	329	255
1680397	358	238
1680397	377	229
1680397	368	225
1680397	385	219
1680397	399	225
Average	364	232
Std. Dev.	26	12
L. Limit (95%)	341	222
U. Limit (95%)	388	243
1680398	306	243
1680398	312	205
1680398	385	232
1680398	316	214
1680398	388	212
1680398	369	223
1680398	268	227
Average	335	222
Std. Dev.	46	13
L. Limit (95%)	292	211
U. Limit (95%)	378	234
1680399	311	208
1680399	256	192
1680399	257	195
1680399	342	184
1680399	321	194
1680399	406	194
1680399	320	211
Average	316	197
Std. Dev.	51	9
L. Limit (95%)	269	188
U. Limit (95%)	364	206

Table 13: Moisture Content of Processed Tobacco

Sample ID	Dry Matter (%)	Moisture (%)
1680397	85.5	14.5
1680397	85.1	14.9
1680397	85.2	14.8
1680397	85.5	14.5
1680397	84.8	15.2
1680397	85.5	14.5
1680397	84.8	15.2
Average	85.2	14.8
Std. Dev.	0.3	0.3
L. Limit (95%)	84.9	14.5
U. Limit (95%)	85.5	15.1
1680398	84.8	15.2
1680398	85.6	14.4
1680398	84.7	15.3
1680398	84.8	15.2
1680398	85.1	14.9
1680398	84.8	15.2
1680398	85.1	14.9
Average	85.0	15.0
Std. Dev.	0.3	0.3
L. Limit (95%)	84.7	14.7
U. Limit (95%)	85.3	15.3
1680399	85.3	14.7
1680399	85.2	14.8
1680399	85.2	14.8
1680399	84.8	15.2
1680399	85.4	14.6
1680399	85.1	14.9
1680399	84.6	15.4
Average	85.1	14.9
Std. Dev.	0.3	0.3
L. Limit (95%)	84.8	14.6
U. Limit (95%)	85.4	15.2