

7.1.: PRODUCT ANALYSIS – HARMFUL AND POTENTIALLY HARMFUL CONSTITUENTS (HPHC)

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7.1. PRODUCT ANALYSIS: HPHC

7.1.1. Purpose of Study

This study establishes the levels of Harmful and Potentially Harmful Constituents (HPHCs) in the candidate product.

The candidate product is a grandfathered product (FDA Grandfather Status # GF1200194) ([Appendix 2.3-1](#)), commercially marketed in the U.S. as of February 15, 2007. As such, it is not a new tobacco product as defined by FDCA Section 910(a) (1) and does not require premarket review and authorization.¹

Section VI(B)(1) of the Modified Risk Tobacco Product Application (MRTPA) Draft Guidance (2012) states, “For each product, FDA recommends that applicants conduct product analyses to determine levels of harmful and potentially harmful constituents (HPHC), including smoke constituents, as appropriate to the product.”

Altria Client Services, LLC (ALCS) tested for constituents as described in the abbreviated list of HPHCs in smokeless tobacco taken from the MRTPA Draft Guidance, “Reporting Harmful and Potentially Harmful Constituents in Tobacco Products and Tobacco Smoke Under Section 904(a)(3) of the FD&C Act.”

Section [6.1](#) of this application provides comparisons of HPHCs in the candidate product relative to other tobacco products.

7.1.2. Scientific Literature Supporting Methodological Relevance

ALCS tests seven replicates of each HPHC in five production lots² of the candidate product. ALCS uses fully validated analytical methods to measure HPHCs. Methods are validated according to the ALCS Analytical Sciences Method Validation Guideline, which follows the International Conference on Harmonization (ICH) Harmonized Tripartite Guideline, Validation of Analytical Procedures: Methodology Q2B, November 1996, in addition to the U.S. Department of Health and Human Services Food and Drug Administration Guidance for Industry, Bioanalytical Method Validation, Draft Guidance, Revision 1, September 2013. All ALCS analytical methods for the determination of HPHCs are accredited to the ISO 17025:2005 standard by A2LA ([Appendix 7.1-8](#), [Appendix 7.1-9](#), and [Appendix 7.1-10](#)).

We use standard test methods for nicotine, pH and total moisture as defined by the Centers for Disease Control and Prevention (CDC), “Protocol for Analysis of Nicotine, Total Moisture and pH in Smokeless Tobacco Products,” as published in the Federal Register Vol. 64, No. 55 March 23, 1999 (and as amended in Vol. 74, No. 4, January 7, 2009).

¹ Copenhagen® Fine Cut and variants thereof have been on the market since 1822. Since 2007, USSTC made minor modifications to Copenhagen® Snuff Fine Cut, which are the subject of a separate pending Substantial Equivalence review. The candidate product subject to the MRTPA is the product for which FDA granted grandfathered status (Grandfather Number – GF1200194) on November 1, 2012.

² Production lots 01000 and Lot 01001 were manufactured on March 8, 2017. Production lots 01004, 01005 and 01006 were manufactured on June 2, 2017.

7.1.3. Experimental Design

Following finished product manufacturing, product is conditioned for (b) (4) as defined in Table 7.1-1. (b) (4)

Table 7.1-1: Sample Handling Summary

Condition Designation	Storage Condition	Duration
(b) (4)		

Testing for HPHCs is conducted on samples at the beginning of the candidate product's retail shelf-life. Additional testing of the candidate product throughout the intended shelf-life is discussed in [Section 7.2](#) of this application. Seven replicates of a single lot are measured for each analysis as recommended in the MRTPA Draft Guidance, "Reporting Harmful and Potentially Harmful Constituents in Tobacco Products and Tobacco Smoke Under Section 904(a)(3) of the FD&C Act."

7.1.4. Study Methodology

Table 7.1-2 summarizes the HPHC measurements performed in this study.

Table 7.1-2: Constituents by Test

Appendix Number	SOP Number	Common Name (CAS #)
7.1-1	095-3370	pH
7.1-2	095-3371	Total Moisture
7.1-3	095-5020	Formaldehyde (50-00-0), Acetaldehyde (75-07-7), Crotonaldehyde (4170-30-3)
7.1-4	095-5021	Benzo[a]pyrene (50-32-8)
7.1-5	095-5507	Cadmium (7440-43-9), Arsenic (7440-38-2)
7.1-6	095-5519	NNN (16543-55-8), NNK (64091-91-4)
7.1-7	095-5529	Nicotine (54-11-5) (total and free)

Table 7.1-3 summarizes the methods used for HPHC testing.

Table 7.1-3: Test Methods

Appendix Number	SOP Number	ALCS Methods
7.1-1	095-3370	Determination of pH by the CDC Method
7.1-2	095-3371	Determination of Total Moisture by the CDC Method
7.1-3	095-5020	Determination of Select Carbonyls in Tobacco by UPLC-MS/MS
7.1-4	095-5021	Determination of B[a]P in Tobacco Products by GC-MS
7.1-5	095-5507	Determination of Cadmium and Arsenic in Tobacco Products by ICP-MS
7.1-6	095-5519	Determination of TSNAs in Tobacco and Tobacco Products by LC-MS/MS
7.1-7	095-5529	Determination of Nicotine in Tobacco and Tobacco Products by GC

ALCS developed and validated the methods in Table 7.1-3. A brief description of each method is given below:

Appendix 7.1-7, SOP 095-5529 Determination of Nicotine in Tobacco and Tobacco Products by GC

Method 095-5529 adheres to the procedures defined in the CDC's "Protocol for Analysis of Nicotine, Total Moisture and pH in Smokeless Tobacco Products," as published in the Federal Register Vol. 64, No. 55 March 23, 1999 (and as amended in Vol. 74, No. 4, January 7, 2009).

Appendix 7.1-6, SOP 095-5519 Determination of TSNAs in Tobacco and Tobacco Products by LC-MS-MS

Deuterated internal standards are added to approximately 0.75 g of tobacco followed by extraction with ammonium acetate. The sample extract is rotated and cleaned by solid-phase extraction (SPE) and analyzed by liquid chromatography with tandem mass spectrometry (LC/MS/MS).

Appendix 7.1-5, SOP 095-5507 Determination of Cadmium and Arsenic in Tobacco Products by ICP-MS

Approximately 0.5 g of tobacco is subjected to a closed vessel microwave digestion using nitric acid. The resulting sample is analyzed by inductively-coupled plasma mass spectrometry (ICP-MS) equipped with a dynamic reaction cell.

Appendix 7.1-4, SOP 095-5021 Determination of Benzo[a]pyrene in Tobacco and Tobacco Products by GC-MS

Deuterated internal standard (B[a]P)-d12) is added to approximately 1.0 g of tobacco followed by extraction with methanol. The methanol extract is cleaned by solid-phase extraction (SPE), concentrated, and analyzed by gas chromatography-mass spectrometry (GC/MS).

Appendix 7.1-3, SOP 095-5020 Determination of Select Carbonyls in Tobacco by UPLC-MS/MS

Approximately 1.0 g of tobacco is extracted with 100 mM ammonium formate (aq) solution. The ammonium formate extract is derivatized with 2,4-dinitrophenylhydrazine (DNPH) and the resulting hydrazines are analyzed by ultra-performance liquid chromatography with tandem mass spectrometry (LC/MS/MS).

Appendix 7.1-2, SOP 095-3371 Determination of Total Moisture by the CDC Method

Method 095-3371 adheres to the procedures defined in the CDC's "Protocol for Analysis of Nicotine, Total Moisture and pH in Smokeless Tobacco Products," as published in the Federal Register Vol. 64, No. 55 March 23, 1999 (and as amended in Vol. 74, No. 4, January 7, 2009).

Appendix 7.1-1, SOP 095-3370 Determination of pH by the CDC Method

Method 095-3370 adheres to the procedures defined in the CDC's "Protocol for Analysis of Nicotine, Total Moisture and pH in Smokeless Tobacco Products," as published in the Federal Register Vol. 64, No. 55 March 23, 1999 (and as amended in Vol. 74, No. 4, January 7, 2009).

Eurofins Lancaster Laboratories Professional Scientific Services (ELLPSS) conducts testing for HPHCs at Altria's Center for Research and Technology (CRT) in Richmond, VA, using methods accredited to the ISO 17025:2005 standard by A2LA ([Appendix 7.1-8](#), [Appendix 7.1-9](#), and [Appendix 7.1-10](#)). ALCS ensures that the laboratory performing HPHC testing is accredited to this international standard. This demonstrates the laboratory's technical competence and ability to produce precise and accurate test data.

7.1.5. Results

The study report summarizes the product data in tabular form as prescribed in section VIII.A.7 of the Modified Risk Tobacco Product Applications Draft Guidance for Industry published in March 2012. Data tables include the mean constituent value and 95% confidence interval (CI) of each lot as well as the combined average and 95% confidence interval of the five (5) lots. We summarize the HPHC data on an as-is and dry weight basis for each lot in [Table 7.1-4](#) through [Table 7.1-13](#). We also present the HPHC data combined for all 5 lots in [Table 7.1-14](#) and [Table 7.1-15](#).

The underlying data for each of the seven replicates for individual constituent results are provided for each lot in [Table 7.1-16](#) through [Table 7.1-25](#) on an as-is basis and dry weight basis. The tables also include the mean constituent value and 95 % confidence interval of each lot.

7.1.6. Conclusion

This HPHC data is generated by fully validated and ISO 17025 accredited methods. We provide levels of HPHCs in the candidate product from five (5) separate lots measured in seven (7) replicates. The HPHC results are found to be comparable with literature reports for marketplace moist smokeless tobacco products (Section [7.5.4-1](#) and [7.5.4-2](#)). For each lot of the candidate product, the precision for each measured constituent was within the respective ISO

17025:2005 method's combined expanded measurement uncertainty range for the seven (7) replicate measurements. ([Appendix 7.1-11](#)) For each measured HPHC averaged across the five lots, we found an increase in the 95 % confidence interval, which is expected and can be attributed to inherent analytical variability and within year crop and process variability from lot-to-lot.

Table 7.1-4: Summary of Individual Lot Results HPHC (As Is) Lot 01000

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	12.6	0.0764	7	095-5529
Nicotine	Free Nicotine	54-11-5	mg/g	3.93	0.0238	7	095-5529
pH	pH	N/A	N/A	7.67	0.0174	7	095-3370
Total Moisture (OV)	Total Moisture (OV)	N/A	%	54.5	0.879	3	095-3371
Cadmium	Cadmium	7440-43-9	ng/g	573	9.72	7	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	120	7.56	7	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	42.4	1.80	7	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	4.12	0.335	7	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	BLOQ	N/A	7	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	0.722	0.0341	7	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	1670	10.2	7	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	543	5.9	7	095-5519

N/A=not applicable; OV=oven volatiles; BLOQ=below limit of quantitation

Table 7.1-5: Summary of Individual Lot Results – HPHC (Dry Weight Basis) – Lot 01000

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	27.8	0.168	7	095-5529
Cadmium	Cadmium	7440-43-9	ng/g	1258	21.4	7	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	265	16.6	7	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	93.1	3.95	7	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	9.04	0.736	7	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	BLOQ	N/A	7	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	1.59	0.0749	7	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	3622	22.2	7	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	1177	12.9	7	095-5519

N/A=not applicable; BLOQ=below limit of quantitation

Table 7.1-6: Summary of Individual Lot Results – HPHC (As-Is) – Lot 01001

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	12.6	0.0572	7	095-5529
Nicotine	Free Nicotine	54-11-5	mg/g	4.30	0.0195	7	095-5529
pH	pH	N/A	N/A	7.73	0.0189	7	095-3370
Total Moisture (OV)	Total Moisture (OV)	N/A	%	54.3	0.220	3	095-3371
Cadmium	Cadmium	7440-43-9	ng/g	567	9.80	7	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	111	9.78	7	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	42.7	1.09	7	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	4.36	0.0539	7	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	ND	N/A	7	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	0.851	0.0393	7	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	1695	37.6	7	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	557	15.6	7	095-5519

N/A=not applicable; ND=none detected; OV=oven volatiles

Table 7.1-7: Summary of Individual Lot Results – HPHC (Dry Weight Basis) – Lot 01001

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	27.6	0.125	7	095-5529
Cadmium	Cadmium	7440-43-9	ng/g	1241	21.4	7	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	242	21.4	7	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	93.4	2.39	7	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	9.54	0.118	7	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	ND	N/A	7	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	1.86	0.0860	7	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	3710	82.3	7	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	1219	34.1	7	095-5519

N/A=not applicable; ND=none detected

Table 7.1-8: Summary of Individual Lot Results – HPHC (As-Is) – Lot 01004

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	12.3	0.0250	7	095-5529
Nicotine	Free Nicotine	54-11-5	mg/g	3.73	0.00761	7	095-5529
pH	pH	N/A	N/A	7.66	0.0220	7	095-3370
Total Moisture (OV)	Total Moisture (OV)	N/A	%	54.7	0.647	3	095-3371
Cadmium	Cadmium	7440-43-9	ng/g	757	9.66	7	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	95.8	4.42	7	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	59.4	0.935	7	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	1.73	0.142	7	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	BLOQ	N/A	7	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	0.617	0.0519	7	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	1780	47.6	7	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	414	12.3	7	095-5519

BLOQ=below limit of quantitation; N/A=not applicable; OV=oven volatiles

Table 7.1-9: Summary of Individual Lot Results – HPHC (Dry Weight Basis) – Lot 01004

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	27.0	0.0552	7	095-5529
Cadmium	Cadmium	7440-43-9	ng/g	1671	21.3	7	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	211	9.75	7	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	131	2.06	7	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	3.81	0.313	7	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	BLOQ	N/A	7	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	1.36	0.115	7	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	3928	105	7	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	915	27.1	7	095-5519

BLOQ=below limit of quantitation; N/A=not applicable

Table 7.1-10: Summary of Individual Lot Results – HPHC (As-Is) – Lot 01005

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	12.3	0.0485	7	095-5529
Nicotine	Free Nicotine	54-11-5	mg/g	3.83	0.0151	7	095-5529
pH	pH	N/A	N/A	7.68	0.00949	7	095-3370
Total Moisture (OV)	Total Moisture (OV)	N/A	%	54.4	0.246	3	095-3371
Cadmium	Cadmium	7440-43-9	ng/g	792	21.2	7	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	101	4.33	7	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	60.2	0.760	7	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	2.05	0.0535	7	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	BLOQ	N/A	7	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	0.692	0.0278	7	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	1789	16.2	7	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	420	7.66	7	095-5519

BLOQ=below limit of quantitation; N/A=not applicable; OV=oven volatiles

Table 7.1-11: Summary of Individual Lot Results – HPHC (Dry Weight Basis) – Lot 01005

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	27.0	0.106	7	095-5529
Cadmium	Cadmium	7440-43-9	ng/g	1739	46.6	7	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	223	9.51	7	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	132	1.67	7	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	4.50	0.118	7	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	BLOQ	N/A	7	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	1.52	0.0610	7	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	3927	35.6	7	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	922	16.8	7	095-5519

BLOQ=below limit of quantitation; N/A=not applicable

Table 7.1-12: Summary of Individual Lot Results – HPHC (As-Is) – Lot 01006

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	12.5	0.0556	7	095-5529
Nicotine	Free Nicotine	54-11-5	mg/g	3.81	0.0170	7	095-5529
pH	pH	N/A	N/A	7.66	0.0136	7	095-3370
Total Moisture (OV)	Total Moisture (OV)	N/A	%	54.3	0.108	3	095-3371
Cadmium	Cadmium	7440-43-9	ng/g	812	22.1	7	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	102	1.95	7	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	61.9	0.439	7	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	2.11	0.0906	7	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	ND	N/A	7	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	0.723	0.0558	7	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	1798	34.2	7	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	427	6.59	7	095-5519

N/A=not applicable; ND=none detected; OV=oven volatiles

Table 7.1-13: Summary of Individual Lot Results – HPHC (Dry Weight Basis) – Lot 01006

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	27.4	0.122	7	095-5529
Cadmium	Cadmium	7440-43-9	ng/g	1777	48.4	7	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	223	4.27	7	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	135	0.961	7	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	4.62	0.198	7	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	ND	N/A	7	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	1.58	0.122	7	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	3937	74.9	7	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	935	14.4	7	095-5519

N/A=not applicable; ND=none detected

Table 7.1-14: Summary of Individual Lot Results – HPHC (As-Is) – 5-Lot Combined

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	12.5	0.228	5	095-5529
Nicotine	Free Nicotine	54-11-5	mg/g	3.92	0.278	5	095-5529
pH	pH	N/A	N/A	7.68	0.0366	5	095-3370
Total Moisture (OV)	Total Moisture (OV)	N/A	%	54.4	0.189	5	095-3371
Cadmium	Cadmium	7440-43-9	ng/g	700	150	5	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	106	12.0	5	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	53.3	12.3	5	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	2.87	1.56	5	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	BLOQ	N/A	5	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	0.721	0.105	5	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	1746	73.8	5	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	472	88.3	5	095-5519

BLOQ=below limit of quantitation; N/A=not applicable; OV=oven volatiles

Table 7.1-15: Summary of Individual Lot Results – HPHC (Dry Weight Basis) – 5-Lot Combined

Constituent	Constituent Common Name	CAS #	Units	Mean Value	95% CI	Sample Size	Measurement Method
Nicotine	Total Nicotine	54-11-5	mg/g	27.4	0.439	5	095-5529
Cadmium	Cadmium	7440-43-9	ng/g	1537	329	5	095-5507
Arsenic	Arsenic	7440-38-2	ng/g	233	26.1	5	095-5507
Benzo[a]pyrene	B[a]P	50-32-8	ng/g	117	27.0	5	095-5021
Acetaldehyde	Acetaldehyde	75-07-7	µg/g	6.30	3.42	5	095-5020
Crotonaldehyde	Crotonaldehyde	4170-30-3	µg/g	BLOQ	N/A	5	095-5020
Formaldehyde	Formaldehyde	50-00-0	µg/g	1.58	0.226	5	095-5020
N-nitrosornicotine	NNN	16543-55-8	ng/g	3825	184	5	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone	NNK	64091-91-4	ng/g	1034	188	5	095-5519

BLOQ=below limit of quantitation; N/A=not applicable

Table 7.1-16: Summary of Individual Lot Results – Constituents (As-Is Basis) – Lot 01000

Constituent (Common Name)	CAS #	Units	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Mean Value	95% CI	Method #
Nicotine (total)	54-11-5	mg/g	12.6	12.7	12.5	12.7	12.7	12.6	12.7	12.6	0.0764	095-5529
Nicotine (free)	54-11-5	mg/g	3.91	3.95	3.89	3.93	3.94	3.91	3.96	3.93	0.0238	095-5529
pH	N/A	pH Units	7.72	7.67	7.67	7.68	7.67	7.66	7.67	7.67	0.0174	095-3370
Moisture (OV)	N/A	%	54.3	54.3	54.9	-----	-----	-----	-----	54.5	0.879	095-3371
Cadmium	7440-43-9	ng/g	586	561	583	564	561	574	578	573	9.72	095-5507
Arsenic	7440-38-2	ng/g	129	112	119	113	114	127	131	120	7.56	095-5507
Benzo[a]pyrene	50-32-8	ng/g	38.5	42.2	43.7	43.2	43.6	41.6	44.0	42.4	1.80	095-5021
Acetaldehyde	75-07-7	µg/g	4.65	3.99	3.64	4.57	4.05	3.93	3.99	4.12	0.335	095-5020
Crotonaldehyde	4170-30-3	µg/g	0.0523	0.0478 ¹	0.0158 ¹	0.0486	0.0324 ¹	0.0344 ¹	0.0403 ¹	BLOQ	N/A	095-5020
Formaldehyde	50-00-0	µg/g	0.775	0.672	0.696	0.726	0.726	0.762	0.699	0.722	0.0341	095-5020
N-nitrosornicotine (NNN)	16543-55-8	ng/g	1663	1672	1661	1677	1654	1686	1676	1670	10.2	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	ng/g	544	535	548	551	533	544	544	543	5.95	095-5519

BLOQ=below limit of quantitation; N/A=not applicable; OV=oven volatiles

¹ Value is below the limit of quantitation for the test method.

Table 7.1-17: Summary of Individual Lot Results – Constituents (Dry weight basis) – Lot 01000

Constituent (Common Name)	CAS #	Units	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Mean Value	95% CI	Method #
Nicotine (total)	54-11-5	mg/g	27.6	27.9	27.5	27.8	27.8	27.6	28.0	27.8	0.168	095-5529
Cadmium	7440-43-9	ng/g	1290	1230	1280	1240	1230	1260	1270	1257	21.4	095-5507
Arsenic	7440-38-2	ng/g	284	245	261	248	250	278	287	265	16.6	095-5507
Benzo[a]pyrene	50-32-8	ng/g	84.5	92.6	96.1	94.9	95.8	91.4	96.8	93.2	3.95	095-5021
Acetaldehyde	75-07-7	µg/g	10.2	8.77	8.00	10.0	8.89	8.64	8.76	9.04	0.736	095-5020
Crotonaldehyde	4170-30-3	µg/g	0.115	0.105 ¹	0.0348 ¹	0.107	0.0711 ¹	0.0755 ¹	0.0885 ¹	BLOQ	N/A	095-5020
Formaldehyde	50-00-0	µg/g	1.70	1.48	1.53	1.59	1.60	1.67	1.54	1.59	0.0749	095-5020
N-nitrosornicotine (NNN)	16543-55-8	ng/g	3607	3626	3603	3638	3587	3656	3636	3622	22.2	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	ng/g	1180	1161	1190	1195	1157	1181	1179	1177	12.9	095-5519

BLOQ=below limit of quantitation; N/A=not applicable

¹ Value is below the limit of quantitation for the test method.

Table 7.1-18: Summary of Individual Lot Results – Constituents (As-Is Basis) – Lot 01001

Constituent (Common Name)	CAS #	Units	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Mean Value	95% CI	Method #
Nicotine (total)	54-11-5	mg/g	12.6	12.5	12.7	12.7	12.6	12.7	12.6	12.6	0.0572	095-5529
Nicotine (free)	54-11-5	mg/g	4.30	4.26	4.31	4.31	4.29	4.33	4.30	4.30	0.0195	095-5529
pH	N/A	pH Units	7.77	7.73	7.70	7.74	7.73	7.74	7.72	7.73	0.0189	095-3370
Moisture (OV)	N/A	%	54.4	54.3	54.3	-----	-----	-----	-----	54.3	0.220	095-3371
Cadmium	7440-43-9	ng/g	571	545	568	564	576	573	574	567	9.80	095-5507
Arsenic	7440-38-2	ng/g	104	127	106	124	103	102	107	111	9.78	095-5507
Benzo[a]pyrene	50-32-8	ng/g	43.3	42.6	40.6	44.2	41.8	43.6	42.5	42.7	1.09	095-5021
Acetaldehyde	75-07-7	µg/g	4.41	4.35	4.38	4.41	4.37	4.24	4.35	4.36	0.054	095-5020
Crotonaldehyde	4170-30-3	µg/g	ND	ND	ND	0.00240 ¹	ND	ND	ND	ND	N/A	095-5020
Formaldehyde	50-00-0	µg/g	0.775	0.816	0.845	0.893	0.868	0.873	0.888	0.851	0.0393	095-5020
N-nitrosornicotine (NNN)	16543-55-8	ng/g	1635	1721	1694	1725	1666	1670	1752	1695	37.6	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	ng/g	583	530	547	554	570	563	553	557	15.6	095-5519

N/A=not applicable; ND=none detected; OV=oven volatiles

¹ Value is below the limit of quantitation for the test method.

Table 7.1-19: Summary of Individual Lot Results – Constituents (Dry Weight Basis) – Lot 01001

Constituent (Common Name)	CAS #	Units	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Mean Value	95% CI	Method #
Nicotine (total)	54-11-5	mg/g	27.7	27.4	27.7	27.7	27.6	27.8	27.7	27.6	0.125	095-5529
Cadmium	7440-43-9	ng/g	1250	1193	1243	1234	1261	1254	1256	1241	21.4	095-5507
Arsenic	7440-38-2	ng/g	228	278	232	272	225	224	234	242	21.4	095-5507
Benzo[a]pyrene	50-32-8	ng/g	94.7	93.2	89.0	96.7	91.6	95.5	92.9	93.4	2.39	095-5021
Acetaldehyde	75-07-7	µg/g	9.65	9.51	9.58	9.64	9.56	9.27	9.53	9.54	0.118	095-5020
Crotonaldehyde	4170-30-3	µg/g	ND	ND	ND	0.00526 ¹	ND	ND	ND	ND	N/A	095-5020
Formaldehyde	50-00-0	µg/g	1.70	1.79	1.85	1.95	1.90	1.91	1.94	1.86	0.0860	095-5020
N-nitrosonornicotine (NNN)	16543-55-8	ng/g	3580	3768	3708	3776	3646	3656	3836	3710	82.3	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	ng/g	1276	1160	1198	1212	1247	1232	1210	1219	34.1	095-5519

N/A=not applicable; ND=none detected

¹ Value is below the limit of quantitation for the test method.

Table 7.1-20: Summary of Individual Lot Results – Constituents (As-Is Basis) – Lot 01004

Constituent (Common Name)	CAS #	Units	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Mean Value	95% CI	Method #
Nicotine (total)	54-11-5	mg/g	12.3	12.3	12.3	12.2	12.3	12.3	12.2	12.3	0.0250	095-5529
Nicotine (free)	54-11-5	mg/g	3.73	3.74	3.73	3.72	3.73	3.73	3.71	3.73	0.00761	095-5529
pH	N/A	pH Units	7.70	7.67	7.66	7.63	7.67	7.66	7.63	7.66	0.0220	095-3370
Moisture (OV)	N/A	%	54.6	55.0	54.5	-----	-----	-----	-----	54.7	0.647	095-3371
Cadmium	7440-43-9	ng/g	769	746	749	757	774	752	752	757	9.66	095-5507
Arsenic	7440-38-2	ng/g	97.7	95.6	105.4	95.4	92.0	92.7	91.7	95.8	4.42	095-5507
Benzo[a]pyrene	50-32-8	ng/g	57.9	59.8	60.3	60.7	58.3	59.6	59.1	59.4	0.935	095-5021
Acetaldehyde	75-07-7	µg/g	1.65	1.69	1.56	1.53	1.90	1.90	1.83	1.73	0.142	095-5020
Crotonaldehyde	4170-30-3	µg/g	0.0097 ¹	0.00712 ¹	0.0167 ¹	0.0171 ¹	0.0164 ¹	0.0184 ¹	0.0188 ¹	BLOQ	N/A	095-5020
Formaldehyde	50-00-0	µg/g	0.639	0.656	0.575	0.521	0.688	0.639	0.598	0.617	0.0519	095-5020
N-nitrosornicotine (NNN)	16543-55-8	ng/g	1740	1862	1823	1743	1715	1787	1789	1780	47.6	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	ng/g	418	392	403	417	426	413	431	414	12.3	095-5519

BLOQ=below limit of quantitation; N/A=not applicable; OV=oven volatiles

¹ Value is below the limit of quantitation for the test method.

Table 7.1-21: Summary of Individual Lot Results – Constituents (Dry Weight Basis) – Lot 01004

Constituent (Common Name)	CAS #	Units	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Mean Value	95% CI	Method #
Nicotine (total)	54-11-5	mg/g	27.1	27.1	27.1	27.0	27.0	27.1	26.9	27.0	0.0552	095-5529
Cadmium	7440-43-9	ng/g	1696	1645	1653	1671	1707	1660	1660	1671	21.3	095-5507
Arsenic	7440-38-2	ng/g	216	211	233	210	203	205	202	211	9.75	095-5507
Benzo[a]pyrene	50-32-8	ng/g	128	132	133	134	129	132	130	131	2.06	095-5021
Acetaldehyde	75-07-7	µg/g	3.65	3.74	3.45	3.39	4.20	4.19	4.04	3.81	0.313	095-5020
Crotonaldehyde	4170-30-3	µg/g	0.0215 ¹	0.0157 ¹	0.0368 ¹	0.0378 ¹	0.0361 ¹	0.0407 ¹	0.0416 ¹	BLOQ	N/A	095-5020
Formaldehyde	50-00-0	µg/g	1.41	1.45	1.27	1.15	1.52	1.41	1.32	1.36	0.115	095-5020
N-nitrosonornicotine (NNN)	16543-55-8	ng/g	3840	4109	4023	3847	3784	3944	3947	3928	105	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	ng/g	923	866	890	919	941	910	952	915	27.1	095-5519

BLOQ=below limit of quantitation; N/A=not applicable

¹ Value is below the limit of quantitation for the test method.

Table 7.1-22: Summary of Individual Lot Results – Constituents (As-Is Basis) – Lot 01005

Constituent (Common Name)	CAS #	Units	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Mean Value	95% CI	Method #
Nicotine (total)	54-11-5	mg/g	12.2	12.3	12.3	12.2	12.3	12.3	12.3	12.3	0.0485	095-5529
Nicotine (free)	54-11-5	mg/g	3.80	3.85	3.83	3.82	3.83	3.85	3.84	3.83	0.0151	095-5529
pH	N/A	pH Units	7.70	7.67	7.67	7.67	7.67	7.67	7.68	7.68	0.00949	095-3370
Moisture (OV)	N/A	%	54.3	54.4	54.5	-----	-----	-----	-----	54.4	0.246	095-3371
Cadmium	7440-43-9	ng/g	799	793	772	838	792	772	779	792	21.2	095-5507
Arsenic	7440-38-2	ng/g	100	106	105	100	99.5	106	93.2	101	4.33	095-5507
Benzo[a]pyrene	50-32-8	ng/g	60.5	60.4	60.0	60.8	60.1	61.1	58.6	60.2	0.760	095-5021
Acetaldehyde	75-07-7	µg/g	2.05	1.98	2.05	2.02	2.00	2.13	2.13	2.05	0.0535	095-5020
Crotonaldehyde	4170-30-3	µg/g	ND	0.00142 ¹	ND	0.0128 ¹	0.00161 ¹	ND	0.00766 ¹	BLOQ	N/A	095-5020
Formaldehyde	50-00-0	µg/g	0.698	0.691	0.680	0.651	0.664	0.736	0.721	0.692	0.0278	095-5020
N-nitrosornicotine (NNN)	16543-55-8	ng/g	1802	1796	1786	1806	1757	1801	1777	1789	16.2	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	ng/g	425	417	430	430	419	413	408	420	7.66	095-5519

BLOQ=below limit of quantitation; N/A=not applicable; ND=none detected; OV=oven volatiles

¹ Value is below the limit of quantitation for the test method.

Table 7.1-23: Summary of Individual Lot Results – Constituents (Dry Weight Basis) – Lot 01005

Constituent (Common Name)	CAS #	Units	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Mean Value	95% CI	Method #
Nicotine (total)	54-11-5	mg/g	26.8	27.1	27.0	26.9	26.9	27.1	27.0	27.0	0.106	095-5529
Cadmium	7440-43-9	ng/g	1753	1741	1695	1840	1738	1694	1711	1739	46.6	095-5507
Arsenic	7440-38-2	ng/g	220	232	232	219	218	233	204	223	9.51	095-5507
Benzo[a]pyrene	50-32-8	ng/g	133	133	132	134	132	134	129	132	1.67	095-5021
Acetaldehyde	75-07-7	µg/g	4.49	4.35	4.50	4.44	4.39	4.67	4.67	4.50	0.118	095-5020
Crotonaldehyde	4170-30-3	µg/g	ND	0.00312 ¹	ND	0.0281 ¹	0.00353 ¹	ND	0.0168 ¹	BLOQ	N/A	095-5020
Formaldehyde	50-00-0	µg/g	1.53	1.52	1.49	1.43	1.46	1.62	1.58	1.52	0.0610	095-5020
N-nitrosonornicotine (NNN)	16543-55-8	ng/g	3954	3943	3919	3963	3855	3953	3900	3927	35.6	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	ng/g	932	916	944	943	919	906	896	922	16.8	095-5519

BLOQ=below limit of quantitation; N/A=not applicable; ND=none detected

¹ Value is below the limit of quantitation for the test method.

Table 7.1-24: Summary of Individual Lot Results – Constituents (As-Is Basis) – Lot 01006

Constituent (Common Name)	CAS #	Units	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Mean Value	95% CI	Method #
Nicotine (total)	54-11-5	mg/g	12.5	12.5	12.5	12.4	12.6	12.4	12.5	12.5	0.0556	095-5529
Nicotine (free)	54-11-5	mg/g	3.82	3.82	3.81	3.80	3.84	3.78	3.82	3.81	0.0170	095-5529
pH	N/A	pH Units	7.70	7.66	7.66	7.65	7.66	7.66	7.66	7.66	0.0136	095-3370
Moisture (OV)	N/A	%	54.4	54.3	54.3	-----	-----	-----	-----	54.3	0.108	095-3371
Cadmium	7440-43-9	ng/g	817	797	801	863	810	794	800	812	22.1	095-5507
Arsenic	7440-38-2	ng/g	103	100	99	106	102	102	100	102	1.95	095-5507
Benzo[a]pyrene	50-32-8	ng/g	61.8	62.2	61.4	62.4	61.9	62.2	61.1	61.9	0.439	095-5021
Acetaldehyde	75-07-7	µg/g	1.93	2.13	2.22	2.13	2.21	2.06	2.08	2.11	0.0906	095-5020
Crotonaldehyde	4170-30-3	µg/g	0.00106 ¹	ND	ND	ND	ND	ND	ND	ND	N/A	095-5020
Formaldehyde	50-00-0	µg/g	0.635	0.732	0.835	0.722	0.732	0.724	0.684	0.723	0.0558	095-5020
N-nitrosornicotine (NNN)	16543-55-8	ng/g	1789	1804	1754	1796	1778	1874	1792	1798	34.2	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	ng/g	427	432	437	416	431	427	420	427	6.59	095-5519

N/A=not applicable; ND=none detected; OV=oven volatiles

¹ Value is below the limit of quantitation for the test method.

Table 7.1-25: Summary of Individual Lot Results – Constituents (Dry Weight Basis) – Lot 01006

Constituent (Common Name)	CAS #	Units	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Mean Value	95% CI	Method #
Nicotine (total)	54-11-5	mg/g	27.4	27.4	27.4	27.3	27.5	27.1	27.4	27.4	0.122	095-5529
Cadmium	7440-43-9	ng/g	1788	1744	1753	1889	1772	1739	1752	1777	48.4	095-5507
Arsenic	7440-38-2	ng/g	225	220	217	231	223	223	220	223	4.27	095-5507
Benzo[a]pyrene	50-32-8	ng/g	135	136	134	137	135	136	134	135	0.961	095-5021
Acetaldehyde	75-07-7	µg/g	4.23	4.66	4.86	4.66	4.84	4.51	4.56	4.62	0.198	095-5020
Crotonaldehyde	4170-30-3	µg/g	0.00233 ¹	ND	ND	ND	ND	ND	ND	ND	N/A	095-5020
Formaldehyde	50-00-0	µg/g	1.39	1.60	1.83	1.58	1.60	1.59	1.50	1.58	0.122	095-5020
N-nitrosornicotine (NNN)	16543-55-8	ng/g	3917	3949	3840	3933	3892	4102	3923	3937	74.9	095-5519
4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	ng/g	936	945	957	912	943	934	919	935	14.4	095-5519

N/A=not applicable; ND=none detected

¹ Value is below the limit of quantitation for the test method.