The Determination of Particle Size Distribution

Client Project: PSD Head to Head Testing

Prepared for:

PMI Research & Development
c/o Philip Morris Products S.A.
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I. REPORT REVISION HISTORY

Revision Type (Initial/Revision)	Version Number	Report Date	Reason for Revision
Initial	0.0	22 January 2020	Initial release
Revision	1.0	5 March 2020	Updated Table I and results to reference SMP codes for each device. Changed puff count in the results to number rather than "1….12" or "1…11". Note was moved into Table II. Added note to Section C on sample collection.

II. OVERVIEW

The objective of this study was to characterize samples through particle size distribution (PSD).

The client provided one sample and three devices, which are listed in Table I. Nine replicates per device were determined to be used for testing.

The analyses requested for this study are listed in Table II. Analytical method summaries and results are included in the attached appendices. The laboratory control type used for acceptance is included on each final table for a given test method, if applicable.

Any method deviation(s) that occurred during the course of this study are included in Section IV, C: Quality Control and Reporting Notes.

III. TESTING FACILITY

Activities were conducted at:

Enthalpy Analytical, LLC
800-1 Capitola Drive
Durham, NC 27713-4385
Phone: (919) 850 - 4392
Fax: (919) 850 - 9012

Enthalpy Analytical, LLC
1470 East Parham Road
Richmond, VA. 23228-2300
Phone: (804) 887 - 2100
Fax: (804) 271 – 5594

**Please refer to Table II for the specific site location where each analysis was conducted.*

IV. TEST SAMPLES

A. Receipt, Storage and Conditioning of Test Samples

- Enthalpy Analytical's Durham, NC facility received the sample and devices on 22 August 2019, 30 November 2019 and 31 December 2019 after being relinquished by PMI Research & Development. The sample was received at ambient temperature and in good condition and assigned project code: 1219-552. Prior to, during, and after analysis, the sample was kept under lock with access only to authorized personnel of Enthalpy Analytical, LLC.
- The sample designations are given in Table I.

- Storage was maintained at ambient conditions (unless otherwise specified by the client) until testing was required.

Table I. Sample Coding

Client Sample ID	Enthalpy Sample ID	Enthalpy Device ID	Sample Type
P1M2 Sticks, ZY51714316	-	-	Heat sticks
IQOS 2.4 US SMP133219	A01-A09	PM141-PM185	device
IQOS 3 Forced WA off - FW v1.0.4 B-79858 SMP133220	B01-B09	PM186-PM190	device
IQOS 3 Forced wet - FW v1.3.192 B-79852 SMP133239	C01-C09	PM191-PM195	device

B. Sample Analysis and Constituents List

All applicable analytical methods have been fully validated (unless otherwise specified). For lists of specific compounds of interest identified in each analyte group to be reported, refer to Table II.

All sample analyses performed were conducted on site from the time the samples were received (22 August 2019) to the date the final report was issued (5 March 2020).

For particle size determination, each sample was tested under a non-intense vaping regimen; 55mL/2sec/30sec. Activation (smoking) consisted of pulling 55mL of air over a 2 second period (a puff) through the IQOS device and a cascade impactor which collected the aerosol particles being generated. Samples were smoked using ELPI smoke machine to dilute and analyzed via MSP cascade impactor. The cascade impactor sizes particles into 8 stages with the following aerodynamic cut-points (in microns, µm): 10, 5.6, 3.2, 1.8, 1.0, 0.56, 0.32, 0.18, as well as, a filter collecting particles less than 0.18 microns in diameter. Three devices were tested in replicates of 9 using P1M2 *Sticks, ZY51714316*. One heat stick was used per replicate. Each heat stick was smoke to depletion.

Refer to method summaries for more information.

Table II. Constituents List

Analyses	Analyte(s)	Analytical Method Reference and Version #	Validation Report #	*Site Location
Aerosol Particle Size Analysis of ENDS **This method was modified for the analysis of heat-not-burn devices. This method is not under the laboratory's A2LA scope of accreditation for heat-not-burn devices.	Particle size MMAD GSD	ENT520** v5.0	-	Durham

C. Quality Control and Reporting Notes

All quality control samples were within limits unless otherwise noted. The results presented in this report are representative of the samples as provided to the laboratory.

Followed guidelines from USP method 41-NF 36 (*United States Pharmacopeia and National Formulary (USP 41-NF 36). Rockville, MD: United States Pharmacopeial Convention; 2016: 6338-6341.*) for sample collection.

Report *1219-522 v1.0* replaces report *1219-522 v0.0* issued on 22 January 2020.

D. Sample Generation and Records

Records will be stored by Enthalpy for a period of ten years. Following this period, all records will be destroyed. Electronic records are maintained indefinitely.

Sample and calibration curve chromatograms are available upon request.

E. Sample and LOD/LOQ Concentration Calculations

Depending on the analysis conducted, analyte concentrations are determined by either an internal or external standard calibration method using the regression equation derived from the calibration curve. Results are then converted and reported on a per weight, per device/cigarette, or per puff basis. Example calculations are provided below for varying analysis types. Please note in the example calculations, nanograms (ng) are shown, however the results may be expressed in other units (mg, µg, pg). Dilution factors may also be used in some methods depending on the sample preparation procedure.

Please note that approximate LOD and LOQ values are calculated using averages for each assay and are not specific to individual samples.

E-Liquid and Tobacco:

E-liquid and tobacco analysis results may be reported on a mass/mass basis, catch weight basis (ng) or mass/volume (ng/mL). The calculation is as follows:

$$\text{Analyte Concentration (ng/g)} = \frac{\text{Concentration (ng/mL)} \times \text{Dilution Factor} \times \text{Extraction Volume (mL)}}{\text{E-Liquid or Tobacco Weight (g)}}$$

In instances where results are required to be reported on a dry weight basis (DWB), the moisture content of a sample (expressed as moisture or oven volatiles) can be determined by any one of several different analytical methods. The following calculation is used to convert an “as is” result to a “dry weight basis” result:

$$\text{Analyte Concentration (ng/g DWB)} = \frac{\text{Analyte Concentration (ng/g)} \times 100}{(100 - \%\ \text{Moisture})}$$

Aerosol and Smoke:

The final results for aerosol or smoke analysis may be reported as catch weight basis (ng), ng/puff, ng/cig, ng/device, or ng/g ACM (aerosol collected mass). The final sample concentrations are calculated using the following equations:

$$\text{Analyte Amount (ng/puff)} = \frac{\text{Concentration (ng/mL)} \times \text{Dilution Factor} \times \text{Extraction Volume (mL)}}{\text{Total \# of Puffs}}$$

$$\text{Analyte Amount (ng/cig or ng/device)} = \frac{\text{Conc. (ng/mL) x Dilution Factor x Extraction Volume (mL)}}{\text{Total \# of Cigar(ette)s or Devices}}$$

$$\text{Analyte Amount (ng/g ACM)} = \frac{\text{Concentration (ng/mL) x Dilution Factor x Extraction Volume (mL)}}{\text{ACM (g)}}$$

Limits of Detection and Quantitation:

The Limit of Detection (LOD) and Limit of Quantitation (LOQ) values are calculated using the same formulas above. The LOD/LOQ value in mass/mL is converted to the final unit by multiplying by the extraction volume and dividing by the preferred unit (grams, puffs, device, etc.). An example calculation is shown below:

$$\text{Limit of Detection (ng/g)} = \frac{\text{LOD (ng/mL) x Dilution Factor x Extraction Volume (mL)}}{\text{E-Liquid or Tobacco Weight (g)}}$$

V. QUALITY STATEMENT\SIGNATURES

I certify to the best of my knowledge, all analytical data presented in this report summary:

- Has been reviewed for consistency and completeness.
- Is accurate, error-free, and legible.
- Has been conducted in accordance with the ISO/IEC 17025 standard; in instances where no regulatory guidance exists or is not applicable, the study was conducted in accordance with Enthalpy Analytical quality and technical procedures, and/or approved protocol.

Outliers were evaluated, where deemed necessary. If any were discovered and an assignable cause was determined, they were noted and repeats conducted.

This report is considered to describe accurately the procedures used in this study and the results obtained.

Electronically signed by: Rebecca Matthews (MEG\rmatthews)
Date: Thursday, March 05, 2020 3:18:30 PM (GMT -05:00)
Reason: Document has been reviewed.

QA Reviewed By: _____

General Reporting Notes

Acronym	Name	Explanation
J ***<LOQ***	*J-Flag* *Less than LOQ*	Indicates detection of the analyte, but at a value less than the LOQ. The laboratory can positively identify the presence of the analyte of interest, but it cannot be reliably quantitated.
LOQ	*Limit of Quantitation*	(aka: *Lowest Standard Value* or *Lower Curve Limit*). The laboratory cannot reliably quantitate analytes of interest below this value within method criteria. The result is considered an estimate.
LOD	*Limit of Detection*	The LOD is how low the instrument can consistently detect analytes in the presence of the sample matrix.
ND	*Non-Detect*	Indicates an analytical result below the LOD.
DF	*Dilution Factor*	This number represents a dilution of the sample during the preparation and/or analysis process. The analytical result taken from a laboratory instrument is multiplied by the DF to determine the final, undiluted sample result.
E	*E-Flag*	Indicates an analytical result exceeding the highest calibration point. The associated value should be considered an estimate.
PCS or PCM	*Process Control Sample or Process Control Monitor*	Clean matrix or a reference matrix that is prepared and analyzed using the same reagents, procedures and spiking standards (if applicable) used for the client samples. Used to assess the control of the laboratory's analytical system. Examples: LCS, 3R4F, CM7
MS	*Matrix Spike*	An aliquot of an actual sample spiked with a known amount of analyte to determine possible percent recovery. The MS indicates what effect the sample matrix may have on the target analyte.
ACM	*Aerosol Collection Mass*	The amount of particulate captured on the pad during aerosol collection.
TPM	*Total Particulate Matter*	The amount of particulate captured on the pad during smoking.
WtLoss	*Device Weight Loss*	Weight loss is the amount of e-liquid mass used during smoking. The device is weighed before and after smoking.

- **Significant Figures**: Three (3) significant figures are reported unless the reported value is much greater than unity (1.00) in the units expressed, in which the value is then rounded to a whole number. For example, a value of 1,456.45 µg/mL is rounded to 1,456 µg/mL (four significant figures).

- **Manual Integration**: The data systems used for processing will flag manually integrated peaks. Should manual integration be necessary (a few reasons listed below), it may be identified by two-letter designations or a written description on sample chromatograms, if provided in the report. Typically, the two-letter codes will accompany the analyst's manual integration stamp placed next to the compound name on the chromatogram.

    - ***NI***: The peak was *not integrated* by the software
    - ***II***: The peak was *integrated incorrectly* by the software
    - ***WP:*** The *wrong peak* was integrated by the software

APPENDIX A

PARTICLE SIZE DISTRIBUTION METHOD SUMMARY AND RESULTS

The results in this test report relate only to the samples identified in this report. This information is confidential and is only to be used by the client identified in this report. Enthalpy Analytical, LLC accepts no liability in the use of this report or the results contained, herein. The original controlled report shall not be reproduced without written approval of Enthalpy Analytical, LLC.

AEROSOL PARTICLE SIZE ANALYSIS OF ENDS
SOP No. ENT520_Rev 5.0*

Electronic Nicotine Delivery Systems (ENDS) devices are smoked using flow controllers that deliver a predetermined puff volume through the ENDS device, which activates the aerosol generation. The aerosol generated is directly drawn through a Cascade Impactor and collected on tare-weighed foils for each stage. The foils are weighed and the mass of aerosol collected on each stage is calculated.

*This method was modified for the analysis of heat-not-burn devices. This method is not under the laboratory's A2LA scope of accreditation for heat-not-burn devices.

Enthalpy Analytical

Job No.: 1219-552-1 ENT520: Particle Size Determination - eC Aerosol

Philip Morris Products S.A. Manufacturing Division PSD Head to Head Testing

SampleName P1M2 Sticks, ZY51714316 (Device: IQOS 2.4 US SMP133219)

Puffs 11

Regime 55mL/2sec/30sec

Mass Per Stage (mg)	A01-1	A02-1	A03-1	A04-1	A05-1	A06-1	A07-1	A08-1	A09-1	Avg
10	0.60	0.10	0.40	0.20	0.00	0.00	0.00	0.00	0.00	0.14
5.6	0.50	0.30	0.30	0.30	0.00	0.00	0.10	0.00	0.00	0.17
3.2	0.60	0.30	0.50	0.00	0.00	0.00	0.10	0.00	0.00	0.17
1.8	0.50	0.30	0.40	0.10	0.50	0.10	0.10	0.00	0.00	0.22
1.0	1.20	1.60	2.20	1.20	0.90	1.50	1.00	0.90	1.30	1.31
0.56	2.40	2.70	2.60	2.80	2.70	2.50	3.50	2.70	4.00	2.88
0.32	1.70	1.60	1.30	2.30	1.90	1.00	1.20	1.70	1.60	1.59
0.18	0.30	0.00	0.20	0.30	0.70	0.10	0.40	0.00	0.50	0.28
<0.18	0.30	0.00	0.00	0.30	0.80	0.10	0.10	0.20	0.50	0.26
Total Catch	8.10	6.90	7.90	7.50	7.50	5.30	6.50	5.50	7.90	7.01

Mass Percent Per Stage	A01-1	A02-1	A03-1	A04-1	A05-1	A06-1	A07-1	A08-1	A09-1	Avg
10	7.4%	1.4%	5.1%	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%
5.6	6.2%	4.3%	3.8%	4.0%	0.0%	0.0%	1.5%	0.0%	0.0%	2.2%
3.2	7.4%	4.3%	6.3%	0.0%	0.0%	0.0%	1.5%	0.0%	0.0%	2.2%
1.8	6.2%	4.3%	5.1%	1.3%	6.7%	1.9%	1.5%	0.0%	0.0%	3.0%
1.0	14.8%	23.2%	27.8%	16.0%	12.0%	28.3%	15.4%	16.4%	16.5%	18.9%
0.56	29.6%	39.1%	32.9%	37.3%	36.0%	47.2%	53.8%	49.1%	50.6%	41.7%
0.32	21.0%	23.2%	16.5%	30.7%	25.3%	18.9%	18.5%	30.9%	20.3%	22.8%
0.18	3.7%	0.0%	2.5%	4.0%	9.3%	1.9%	6.2%	0.0%	6.3%	3.8%
<0.18	3.7%	0.0%	0.0%	4.0%	10.7%	1.9%	1.5%	3.6%	6.3%	3.5%

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Puffs 11

Regime 55mL/2sec/30sec

Cumulative Mass < Current	A01-1	A02-1	A03-1	A04-1	A05-1	A06-1	A07-1	A08-1	A09-1	Avg
10	92.6%	98.6%	94.9%	97.3%	100.0%	100.0%	100.0%	100.0%	100.0%	98.2%
5.6	86.4%	94.2%	91.1%	93.3%	100.0%	100.0%	98.5%	100.0%	100.0%	96.0%
3.2	79.0%	89.9%	84.8%	93.3%	100.0%	100.0%	96.9%	100.0%	100.0%	93.8%
1.8	72.8%	85.5%	79.7%	92.0%	93.3%	98.1%	95.4%	100.0%	100.0%	90.8%
1.0	58.0%	62.3%	51.9%	76.0%	81.3%	69.8%	80.0%	83.6%	83.5%	71.8%
0.56	28.4%	23.2%	19.0%	38.7%	45.3%	22.6%	26.2%	34.5%	32.9%	30.1%
0.32	7.4%	0.0%	2.5%	8.0%	20.0%	3.8%	7.7%	3.6%	12.7%	7.3%
0.18	3.7%	0.0%	0.0%	4.0%	10.7%	1.9%	1.5%	3.6%	6.3%	3.5%

Aerodynamic Distribution	A01-1	A02-1	A03-1	A04-1	A05-1	A06-1	A07-1	A08-1	A09-1	Avg
D10 (um)	0.33	0.41	0.44	0.31	0.29	0.44	0.44	0.39	0.40	0.38
D50 (um)	0.86	0.84	0.97	0.66	0.60	0.79	0.72	0.66	0.67	0.75
D90 (um)	2.24	1.71	2.17	1.40	1.25	1.42	1.19	1.14	1.13	1.52
GSD	2.12	1.74	1.87	1.79	1.78	1.58	1.48	1.52	1.51	1.71

Enthalpy Analytical

Job No.: 1219-552-1 ENT520: Particle Size Determination - eC Aerosol

Philip Morris Products S.A. Manufacturing Division PSD Head to Head Testing

SampleName P1M2 Sticks, ZY51714316 (Device: IQOS 3 Forced WA off - FW v1.0.4 B-79858 SMP133220)

Puffs 12

Regime 55mL/2sec/30sec

Mass Per Stage (mg)	B01-1	B02-1	B03-1	B04-1	B05-1	B06-1	B07-1	B08-1	B09-1	Avg
10	0.10	0.00	0.10	0.00	0.00	0.00	0.10	0.00	0.00	0.03
5.6	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.01
3.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.8	0.00	0.40	0.00	0.00	1.00	0.00	0.00	0.20	0.00	0.18
1.0	0.90	0.70	1.10	1.40	1.50	1.10	1.30	1.80	1.10	1.21
0.56	3.00	3.90	3.80	3.80	3.20	3.30	4.50	3.00	3.30	3.53
0.32	2.00	0.80	2.00	0.50	1.50	1.50	1.40	1.30	2.00	1.44
0.18	0.20	0.00	0.40	0.00	0.30	0.10	0.20	0.20	0.10	0.17
<0.18	0.20	0.20	0.10	0.30	0.10	0.00	0.20	0.20	0.20	0.17
Total Catch	6.40	6.00	7.50	6.00	7.60	6.00	7.80	6.70	6.70	6.74

Mass Percent Per Stage	B01-1	B02-1	B03-1	B04-1	B05-1	B06-1	B07-1	B08-1	B09-1	Avg
10	1.6%	0.0%	1.3%	0.0%	0.0%	0.0%	1.3%	0.0%	0.0%	0.5%
5.6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.0%	0.1%
3.2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1.8	0.0%	6.7%	0.0%	0.0%	13.2%	0.0%	0.0%	3.0%	0.0%	2.5%
1.0	14.1%	11.7%	14.7%	23.3%	19.7%	18.3%	16.7%	26.9%	16.4%	18.0%
0.56	46.9%	65.0%	50.7%	63.3%	42.1%	55.0%	57.7%	44.8%	49.3%	52.7%
0.32	31.3%	13.3%	26.7%	8.3%	19.7%	25.0%	17.9%	19.4%	29.9%	21.3%
0.18	3.1%	0.0%	5.3%	0.0%	3.9%	1.7%	2.6%	3.0%	1.5%	2.3%
<0.18	3.1%	3.3%	1.3%	5.0%	1.3%	0.0%	2.6%	3.0%	3.0%	2.5%

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SampleName P1M2 Sticks, ZY51714316 (Device: IQOS 3 Forced WA off - FW v1.0.4 B-79858 SMP133220)

Puffs 12

Regime 55mL/2sec/30sec

Cumulative Mass < Current	B01-1	B02-1	B03-1	B04-1	B05-1	B06-1	B07-1	B08-1	B09-1	Avg
10	98.4%	100.0%	98.7%	100.0%	100.0%	100.0%	98.7%	100.0%	100.0%	99.5%
5.6	98.4%	100.0%	98.7%	100.0%	100.0%	100.0%	97.4%	100.0%	100.0%	99.4%
3.2	98.4%	100.0%	98.7%	100.0%	100.0%	100.0%	97.4%	100.0%	100.0%	99.4%
1.8	98.4%	93.3%	98.7%	100.0%	86.8%	100.0%	97.4%	97.0%	100.0%	96.9%
1.0	84.4%	81.7%	84.0%	76.7%	67.1%	81.7%	80.8%	70.1%	83.6%	78.9%
0.56	37.5%	16.7%	33.3%	13.3%	25.0%	26.7%	23.1%	25.4%	34.3%	26.1%
0.32	6.2%	3.3%	6.7%	5.0%	5.3%	1.7%	5.1%	6.0%	4.5%	4.9%
0.18	3.1%	3.3%	1.3%	5.0%	1.3%	0.0%	2.6%	3.0%	3.0%	2.5%

Aerodynamic Distribution	B01-1	B02-1	B03-1	B04-1	B05-1	B06-1	B07-1	B08-1	B09-1	Avg
D10 (um)	0.37	0.51	0.40	0.53	0.41	0.44	0.46	0.41	0.39	0.43
D50 (um)	0.64	0.76	0.67	0.79	0.79	0.71	0.73	0.77	0.66	0.73
D90 (um)	1.13	1.12	1.12	1.19	1.55	1.15	1.16	1.44	1.14	1.22
GSD	1.55	1.36	1.50	1.37	1.68	1.46	1.43	1.63	1.52	1.50

Enthalpy Analytical

Job No.: 1219-552-1 ENT520: Particle Size Determination - eC Aerosol

Philip Morris Products S.A. Manufacturing Division PSD Head to Head Testing

SampleName P1M2 Sticks, ZY51714316 (Device: IQOS 3 Forced wet - FW v1.3.192 B-79852 SMP133239)

Puffs 12

Regime 55mL/2sec/30sec

Mass Per Stage (mg)	C01-1	C02-1	C03-1	C04-1	C05-1	C06-1	C07-1	C08-1	C09-1	Avg
10	0.00	0.00	0.40	0.30	0.10	0.00	0.00	0.10	0.00	0.10
5.6	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.20	0.00	0.07
3.2	0.00	0.10	0.30	0.00	0.00	0.00	0.00	0.00	0.10	0.06
1.8	0.70	0.10	0.30	0.00	0.00	0.00	0.10	0.40	0.10	0.19
1.0	1.30	0.80	1.00	0.80	1.90	1.20	1.20	1.50	1.00	1.19
0.56	3.80	4.30	2.70	4.00	3.40	4.10	3.70	4.30	4.20	3.83
0.32	1.00	1.00	1.40	0.60	1.20	1.60	0.90	1.70	1.10	1.17
0.18	0.00	0.20	0.40	0.10	0.00	0.20	0.00	0.00	0.00	0.10
<0.18	0.00	0.40	0.30	0.10	0.00	0.10	0.30	0.20	0.20	0.18
Total Catch	6.80	6.90	7.20	5.90	6.60	7.20	6.20	8.40	6.70	6.88

Mass Percent Per Stage	C01-1	C02-1	C03-1	C04-1	C05-1	C06-1	C07-1	C08-1	C09-1	Avg
10	0.0%	0.0%	5.6%	5.1%	1.5%	0.0%	0.0%	1.2%	0.0%	1.5%
5.6	0.0%	0.0%	5.6%	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%	0.9%
3.2	0.0%	1.4%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	0.8%
1.8	10.3%	1.4%	4.2%	0.0%	0.0%	0.0%	1.6%	4.8%	1.5%	2.6%
1.0	19.1%	11.6%	13.9%	13.6%	28.8%	16.7%	19.4%	17.9%	14.9%	17.3%
0.56	55.9%	62.3%	37.5%	67.8%	51.5%	56.9%	59.7%	51.2%	62.7%	56.2%
0.32	14.7%	14.5%	19.4%	10.2%	18.2%	22.2%	14.5%	20.2%	16.4%	16.7%
0.18	0.0%	2.9%	5.6%	1.7%	0.0%	2.8%	0.0%	0.0%	0.0%	1.4%
<0.18	0.0%	5.8%	4.2%	1.7%	0.0%	1.4%	4.8%	2.4%	3.0%	2.6%

Enthalpy Analytical

Job No.: 1219-552-1 ENT520: Particle Size Determination - eC Aerosol

Philip Morris Products S.A. Manufacturing Division PSD Head to Head Testing

SampleName P1M2 Sticks, ZY51714316 (Device: IQOS 3 Forced wet - FW v1.3.192 B-79852 SMP133239)

Puffs 12

Regime 55mL/2sec/30sec

Cumulative Mass < Current	C01-1	C02-1	C03-1	C04-1	C05-1	C06-1	C07-1	C08-1	C09-1	Avg
10	100.0%	100.0%	94.4%	94.9%	98.5%	100.0%	100.0%	98.8%	100.0%	98.5%
5.6	100.0%	100.0%	88.9%	94.9%	98.5%	100.0%	100.0%	96.4%	100.0%	97.6%
3.2	100.0%	98.6%	84.7%	94.9%	98.5%	100.0%	100.0%	96.4%	98.5%	96.8%
1.8	89.7%	97.1%	80.6%	94.9%	98.5%	100.0%	98.4%	91.7%	97.0%	94.2%
1.0	70.6%	85.5%	66.7%	81.4%	69.7%	83.3%	79.0%	73.8%	82.1%	76.9%
0.56	14.7%	23.2%	29.2%	13.6%	18.2%	26.4%	19.4%	22.6%	19.4%	20.7%
0.32	0.0%	8.7%	9.7%	3.4%	0.0%	4.2%	4.8%	2.4%	3.0%	4.0%
0.18	0.0%	5.8%	4.2%	1.7%	0.0%	1.4%	4.8%	2.4%	3.0%	2.6%

Aerodynamic Distribution	C01-1	C02-1	C03-1	C04-1	C05-1	C06-1	C07-1	C08-1	C09-1	Avg
D10 (um)	0.51	0.47	0.36	0.53	0.48	0.44	0.48	0.45	0.49	0.47
D50 (um)	0.82	0.71	0.77	0.77	0.81	0.70	0.76	0.77	0.74	0.76
D90 (um)	1.31	1.07	1.65	1.12	1.37	1.12	1.18	1.31	1.13	1.25
GSD	1.44	1.38	1.81	1.34	1.50	1.44	1.41	1.52	1.38	1.47

APPENDIX B

DEVICE LIST

The results in this test report relate only to the samples identified in this report. This information is confidential and is only to be used by the client identified in this report. Enthalpy Analytical, LLC accepts no liability in the use of this report or the results contained, herein. The original controlled report shall not be reproduced without written approval of Enthalpy Analytical, LLC.

Enthalpy Analytical

Job No.: 1219-552-1 ENT520: Particle Size Determination - eC Aerosol

Philip Morris Products S.A. Manufacturing Division PSD Head to Head Testing

Client Sample Name	Device ID	Run No	Battery ID	Battery Serial No	Model Name	Model No
P1M2 Sticks, ZY51714316 (Device: IQOS 2.4 US)	A01	1	PM152	TUAW 1ZV 3UQ G1AL	IQOS 2.4 US SMP133219	A1502
	A02	1	PM151	T9Q2 CE1 H1X 65XA	IQOS 2.4 US SMP133219	A1502
	A03	1	PM164	T75Y AAA 64C W0TT	IQOS 2.4 US SMP133219	A1502
	A04	1	PM152	TUAW 1ZV 3UQ G1AL	IQOS 2.4 US SMP133219	A1502
	A05	1	PM166	T0H7 TXF 4RS W8F7	IQOS 2.4 US SMP133219	A1502
	A06	1	PM158	TKMQ 2PH YR4 6TFT	IQOS 2.4 US SMP133219	A1502
	A07	1	PM151	T9Q2 CE1 H1X 65XA	IQOS 2.4 US SMP133219	A1502
	A08	1	PM164	T75Y AAA 64C W0TT	IQOS 2.4 US SMP133219	A1502
	A09	1	PM152	TUAW 1ZV 3UQ G1AL	IQOS 2.4 US SMP133219	A1502
P1M2 Sticks, ZY51714316 (Device: IQOS 3 Forced WA off - FW v1.0.4 B-79858)	B01	1	PM187	TEKA 612 UR6 HW5N	IQOS 3 Forced WA off SMP133220	FW v1.0.4
	B02	1	PM186	TALH AT9 MMQ 8636	IQOS 3 Forced WA off SMP133220	FW v1.0.4
	B03	1	PM189	TH7E QVX 7S2 KDLM	IQOS 3 Forced WA off SMP133220	FW v1.0.4
	B04	1	PM190	TUF6 DRL HHZ Q7SQ	IQOS 3 Forced WA off SMP133220	FW v1.0.4
	B05	1	PM188	T9B9 D17 NE4 YV8T	IQOS 3 Forced WA off SMP133220	FW v1.0.4
	B06	1	PM187	TEKA 612 UR6 HW5N	IQOS 3 Forced WA off SMP133220	FW v1.0.4
	B07	1	PM189	TH7E QVX 7S2 KDLM	IQOS 3 Forced WA off SMP133220	FW v1.0.4
	B08	1	PM190	TUF6 DRL HHZ Q7SQ	IQOS 3 Forced WA off SMP133220	FW v1.0.4
	B09	1	PM186	TALH AT9 MMQ 8636	IQOS 3 Forced WA off SMP133220	FW v1.0.4
P1M2 Sticks, ZY51714316 (Device: IQOS 3 Forced wet - FW v1.3.192 B-79852)	C01	1	PM195	TNFQ CKK 9ZU 958A	IQOS 3 Forced wet SMP133239	FW v1.3.192
	C02	1	PM191	TFN4 W6Q W94 0FYU	IQOS 3 Forced wet SMP133239	FW v1.3.192
	C03	1	PM193	TAHP 9M6 6BZ 9X65	IQOS 3 Forced wet SMP133239	FW v1.3.192
	C04	1	PM192	T98E DW4 732 ZLBT	IQOS 3 Forced wet SMP133239	FW v1.3.192
	C05	1	PM191	TFN4 W6Q W94 0FYU	IQOS 3 Forced wet SMP133239	FW v1.3.192
	C06	1	PM193	TAHP 9M6 6BZ 9X65	IQOS 3 Forced wet SMP133239	FW v1.3.192
	C07	1	PM195	TNFQ CKK 9ZU 958A	IQOS 3 Forced wet SMP133239	FW v1.3.192
	C08	1	PM194	TKSR HJ4 H0B 4A8D	IQOS 3 Forced wet SMP133239	FW v1.3.192
	C09	1	PM192	T98E DW4 732 ZLBT	IQOS 3 Forced wet SMP133239	FW v1.3.192

APPENDIX C

CHAIN OF CUSTODY

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PHILIP MORRIS INTERNATIONAL

Record ID.: *R20190730-01*

Title: Good Receipt Note

This form is related to PMI-RRP-SOP-111905

Receiver's Site: Enthalpy Analytical, Inc. 800-1 Capitola Drive, Durham, NC 27713

Responsible Site Receiver: (b) (6), Phone: (b) (6)

Study Name & No: Enthalpy - P1M2 monitor samples

PO number: N/A

Date: 19.08.2019

Goods Description	Batch #	Quantity	Unit	Remarks
P1M2	IC-2911171	1	Boxe	50 bundles of 10 packs with 20 cigarettes
-	-	-	-	-

General Remarks:
Please return the form duly filled and signed to: PTTestItemManagement.RD@pmi.com

Delivery Checked by... (b) (6) (b) (6) .....

Date... 8/22/19 ..... Signature .. (b) (6)

good condition. ambient. TKF 8/22/19

(b) (6) 8/22/19

PHILIP MORRIS INTERNATIONAL

Title: Good Receipt Note

Project Code: 1219-552 (Q19494R1)
Report Version: 1.0

This form is related to PMI-RRP-SOP-111905

Receiver's Site: Enthalpy Analytical, Inc. 800-1 Capitola Drive, Durham, NC 27713

Responsible Site Receiver: (b) (6), Phone: (b) (6)

Study Name & No: Enthalpy - IQOS 3.0 DSD

PO number: N/A

Date: 23.12.2019

Goods Description	Batch #	Quantity	Unit	Remarks
FW v1.0.4	B-79858	5	Devices	N/A
FW v1.3.192	B-79852	5	Devices	N/A

General Remarks:
Please return the form duly filled and signed to: PTTestItemManagement.RD@pmi.com

Delivery Checked by (b) (6)

Date 12/31/19 Signature (b) (6)

good condition. ambient. (b) (6) 12/31/19

QA: (b) (6) 12/31/19

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