

Addendum to FDA Briefing Document

January 24-25, 2018

**Meeting of the Tobacco Products Scientific Advisory
Committee (TPSAC)**

Modified Risk Tobacco Product Applications (MRTPAs)
MR0000059-MR0000061
Philip Morris Products S.A.

Office of Science
Center for Tobacco Products
Food and Drug Administration

TABLE 1. COMPOUNDS IN MARLBORO HEATSTICKS COMPARED WITH REFERENCE CIGARETTE 3R4F AND MEAN OF 31 PMP S.A. CIGARETTES (“MODIFIED” HEALTH CANADIAN INTENSE)

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
1,3-Butadiene	µg/stick	0.21	89.2	↓ 99.8	117.0	↓ 99.8
1-Aminonaphthalene	ng/stick	0.043	20.9	↓ 99.8	32.1	↓ 99.8
2-Aminonaphthalene	ng/stick	0.022	17.5	↓ 99.9	20.1	↓ 99.9
3-Aminobiphenyl	ng/stick	0.007	4.60	↓ 99.8		
NNK	ng/stick	7.80	244.7	↓ 97	128	↓ 94
4-Aminobiphenyl	ng/stick	0.009	3.21	↓ 99.7	3.4	↓ 99.7
Acetaldehyde	µg/stick	192	1602	↓ 88	1467.0	↓ 87
Acetamide	µg/stick	2.96	13.0	↓ 77		
Acetone	µg/stick	30.7	653	↓ 95		
Acrolein	µg/stick	8.32	158	↓ 95	159.0	↓ 94
Acrylamide	µg/stick	1.58	4.5	↓ 65		
Acrylonitrile	µg/stick	0.145	21.2	↓ 99.3	23.6	↓ 99
Ammonia	µg/stick	12.2	33.2	↓ 63	31.0	↓ 60
Arsenic	ng/stick	<0.36	<7.49	NA		
Benz[a]anthracene	ng/stick	2.65	28.4	↓ 91		
Benzene	µg/stick	0.45	77.3	↓ 99.4	87.0	↓ 99
Benzo[a]pyrene	ng/stick	0.736	13.3	↓ 94	15.3	↓ 95
Butyraldehyde	µg/stick	20.7	81.3	↓ 74		
Cadmium	ng/stick	<0.28	89.2	↓ >99.7		
Carbon monoxide	mg/stick	0.35	29.4	↓ 99	28.0	↓ 99
Catechol	µg/stick	14.0	84.1	↓ 83		
Chromium	ng/stick	<11.0	<11.9	NA		
Crotonaldehyde	µg/stick	<3.29	49.3	↓ >93	51.1	↓ >93
Dibenz[a,h] anthracene	ng/stick	<0.124	<0.689	NA		
Ethylene oxide	µg/stick	<0.119	16.0	↓ >99.3		
Formaldehyde	µg/stick	14.1	79.4	↓ 82	91.5	↓ 85
Glycerol	mg/stick	5.02	2.08	↑ 141		
Hydrogen cyanide	µg/stick	<1.75	329	↓ >99.5		
Hydroquinone	µg/stick	6.55	94.5	↓ 93		
Isoprene	µg/stick	1.51	891	↓ 99.8	1005	↓ 99.8
Lead	ng/stick	2.23	31.2	↓ 93		
m-Cresol	µg/stick	0.042	4.24	↓ 99		
Mercury	ng/stick	1.38	3.68	↓ 63		
Methyl-ethyl-ketone	µg/stick	10.1	183	↓ 94		
Nickel	ng/stick	<15.9	<12.9	NA		
Nicotine	mg/stick	1.29	1.74	↓ 26	2.00	↓ 36
Nitric oxide	µg/stick	12.6	484	↓ 97		

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
Nitro benzene	µg/stick	<0.011	<0.038	NA		
Nitrogen oxides	µg/stick	14.2	538	↓ 97		
N-nitrosoanabasine	ng/stick	2.35	29.0	↓ 92		
N-nitrosoanatabine	ng/stick	14.7	254	↓ 94		
NNN	ng/stick	10.1	271	↓ 96	184	↓ 95
o-Cresol	µg/stick	0.078	4.81	↓ 98		
o-Toluidine	ng/stick	1.10	96.2	↓ 99		
p-Cresol	µg/stick	0.071	9.60	↓ 99		
Phenol	µg/stick	1.47	15.6	↓ 91		
Propionaldehyde	µg/stick	10.8	109	↓ 90		
Propylene oxide	ng/stick	142.3	896	↓ 84		
Pyrene	ng/stick	8.20	79.2	↓ 90		
Pyridine	µg/stick	6.58	30.9	↓ 79		
Quinoline	µg/stick	<0.011	0.43	↓ >98		
Resorcinol	µg/stick	<0.055	1.72	↓ >97		
Selenium	ng/stick	1.27	<4.42	NA		
Styrene	µg/stick	0.58	13.9	↓ 96		
Tar	mg/stick	19.4	25.0	↓ 22		
Toluene	µg/stick	1.42	129	↓ 99	149.0	↓ 99
Vinyl chloride	ng/stick	<0.657	93.4	↓ >99		
Water	mg/stick	30.2	14.7	↑ 105		
Propylene glycol	µg/stick	175	23.7	↑ 638		
1-Hydroxy-2-propanone (1,2-Propenediol)	µg/stick	162	96.8	↑ 67		
2-Furanmethanol	µg/stick	39.2	7.00	↑ 460		
2-Furancarboxaldehyde, 5-methyl-	µg/stick	11.1	2.94	↑ 278		
Trans-4-hydroxymethyl-2-methyl-1,3-dioxolane	µg/stick	2.09	0.044	↑ 4650		
Butyrolactone	µg/stick	4.08	0.728	↑ 460		
Furfural	µg/stick	31.1	25.9	↑ 20		
2-Cyclopentene-1,4-dione	µg/stick	3.80	0.764	↑ 397		
2-Propanone, 1-(acetyloxy)-	µg/stick	16.9	8.01	↑ 111		
1-Hydroxy-2-butanone	µg/stick	0.947	0.465	↑ 104		
2-Methylcyclobutane-1,3-dione	µg/stick	2.78	0.710	↑ 292		

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
2(5H)-Furanone	µg/stick	5.32	1.99	↑ 167		
Hexadecanoic acid, ethyl ester	µg/stick	0.491	0.008	↑ 6038		
1,2,3-Propanetriol, diacetate (diacetin)	µg/stick	1.23	0.381	↑ 223		
Phenylacetaldehyde	µg/stick	1.41	0.529	↑ 167		
Butylated hydroxytoluene	µg/stick	0.132	0.007	↑ 1786		
2-Furanmethanol, 5-methyl-	µg/stick	0.123	0.029	↑ 324		
p-Menthan-3-ol	µg/stick	0.786	0.322	↑ 144		
Maltoxazine	µg/stick	0.077	0.038	↑ 103		
Stearate, ethyl-	µg/stick	0.074	0.003	↑ 2367		
Cis-sesquisabinene hydrate	µg/stick	0.061	0.000	↑		
1,4-Dioxane, 2-ethyl-5-methyl-	µg/stick	0.055	0.0004	↑ 13650		
Methyl furoate	µg/stick	0.147	0.029	↑ 407		
3(2H)-Furanone, dihydro-2-methyl-	µg/stick	0.326	0.119	↑ 174		
3-Methylvaleric acid	µg/stick	5.10	3.63	↑ 40		
4(H)-Pyridine, N-acetyl-	µg/stick	0.296	0.112	↑ 164		
Ethyl dodecanoate (ethyl laurate)	µg/stick	0.023	0.000	↑		
Eicosane, 2-methyl-	µg/stick	0.050	0.014	↑ 257		
Benzenemethanol, 4-hydroxy-	µg/stick	0.011	0.000	↑		
Heneicosane, 2-methyl-	µg/stick	0.063	0.021	↑ 200		
2,4-Dimethylcyclopent-4-ene-1,3-dione	µg/stick	0.333	0.193	↑ 73		
Anhydro linalool oxide	µg/stick	0.457	0.291	↑ 57		
2-Formyl-1-methylpyrrole	µg/stick	0.128	0.064	↑ 100		
2,3-Dihydro-5-hydroxy-6-methyl-4H-pyran-4-one	µg/stick	0.231	0.135	↑ 71		
Benzene, 1,2,3,4-tetramethyl-4-(1-methylethenyl)-	µg/stick	0.006	0.005	↑ 20		
Cyclohexane, 1,2-dioxo-	µg/stick	0.083	0.046	↑ 80		
1H-Indene, 2,3-dihydro-1,1,5,6-tetramethyl-	µg/stick	0.026	0.014	↑ 86		
Cyclohexane-1,2-dione, 3-methyl-	µg/stick	0.101	0.073	↑ 38		
1,2-Propanediol, 3-	µg/stick	9.94	5.93	↑ 68		

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
chloro-						
Glycidol	µg/stick	5.71	1.76	↑ 224		
Pyranone	µg/stick	9.26	5.84	↑ 59		
Pyranone	µg/stick	6.54	5.07	↑ 29		
Ethyl linolenate	µg/stick	0.614	0.153	↑ 301		
Ethyl linoleate	µg/stick	0.135	0.008	↑ 1588		
Lanost-8-en-3-ol, 24-methylene-, (3beta)	µg/stick	6.30	1.61	↑ 291		
12,14-Labdadiene-7,8-diol, (8a,12E)	µg/stick	1.43	0.064	↑ 2134		
Isolinderanolide	µg/stick	4.99	1.85	↑ 170		
Ethyl 2,4-dioxohexanoate	µg/stick	6.73	3.57	↑ 89		
Benzoic acid, 2,5-dihydroxy-methyl	µg/stick	4.55	2.18	↑ 109		
Ergosterol	µg/stick	3.18	1.58	↑ 101		
Labdane-8,15-diol, (13S)	µg/stick	0.143	0.015	↑ 853		
2H-Pyran-2-one, tetrahydro-5-hydroxy	µg/stick	4.45	3.11	↑ 43		
5-Methylfurfural	µg/stick	0.995	0.632	↑ 57		
Isoquinoline, 3-methyl	µg/stick	6.29	4.99	↑ 26		
Pyridoxin	µg/stick	0.699	0.526	↑ 33		

Data Source: Section 3.3.2 and section 6.1.1.3.4 of the MRTPAs and Appendix A of an amendment to the MRTPAs submitted on December 8, 2017.

TABLE 2. COMPOUNDS IN MARLBORO SMOOTH MENTHOL HEATSTICKS COMPARED WITH REFERENCE CIGARETTE 3R4F AND MEAN OF 31 PMP S.A. CIGARETTES (“MODIFIED” HEALTH CANADIAN INTENSE)

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
1,3-Butadiene	µg/stick	0.22	92.8	↓ 99.8	117.0	↓ 99.8
1-Aminonaphthalene	ng/stick	0.043	20.9	↓ 99.8	32.1	↓ 99.8
2-Aminonaphthalene	ng/stick	0.022	17.3	↓ 99.9	20.1	↓ 99.9
3-Aminobiphenyl	ng/stick	0.008	4.6	↓ 99.8		
NNK	ng/stick	6.6	256	↓ 97	128	↓ 95
4-Aminobiphenyl	ng/stick	0.009	3.2	↓ 99.7	3.43	↓ 99.7
Acetaldehyde	µg/stick	206	1612	↓ 87	1467	↓ 86
Acetamide	µg/stick	2.98	14	↓ 79		
Acetone	µg/stick	37.8	648	↓ 94		
Acrolein	µg/stick	9.8	144	↓ 93	159	↓ 93
Acrylamide	µg/stick	1.64	4.7	↓ 65		
Acrylonitrile	µg/stick	0.13	22.1	↓ 99.4	23.6	↓ 99
Ammonia	µg/stick	11.1	32.2	↓ 65	31.0	↓ 64
Arsenic	ng/stick	<1.2	<7.49	NA		
Benz[a]anthracene	ng/stick	1.80	26.5	↓ 93		
Benzene	µg/stick	0.45	79.7	↓ 99.4	87.0	↓ 99.4
Benzo[a]pyrene	ng/stick	0.54	12.5	↓ 96	15.3	↓ 96
Butyraldehyde	µg/stick	21.1	83.4	↓ 75		
Cadmium	ng/stick	<0.28	89	↓ >99.7		
Carbon monoxide	mg/stick	0.320	30.8	↓ 99	28.0	↓ 99
Catechol	µg/stick	11.5	92.8	↓ 88		
Chromium	ng/stick	<3.31	<11.9	NA		
Crotonaldehyde	µg/stick	<3.29	48.2	↓ >93	51.1	↓ >93
Dibenz[a,h] anthracene	ng/stick	<0.124	<0.689	NA		
Ethylene oxide	µg/stick	<0.119	19.0	↓ >99.4		
Formaldehyde	µg/stick	15.2	67.9	↓ 78	91.5	↓ 84
Glycerol	mg/stick	4.41	2.15	↑ 105		
Hydrogen cyanide	µg/stick	<1.75	331	↓ >99.5		
Hydroquinone	µg/stick	4.99	97	↓ 95		
Isoprene	µg/stick	1.5	956	↓ 99.8	1005	↓ 99.8
Lead	ng/stick	1.87	31.2	↓ 94		
m-Cresol	µg/stick	0.027	4.2	↓ 99.4		
Menthol	mg/stick	1.77	-			
Mercury	ng/stick	1.32	3.7	↓ 64		
Methyl-ethyl-ketone	µg/stick	13.9	178	↓ 92		
Nickel	ng/stick	<15.9	<43.1	NA		

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
Nicotine	mg/stick	1.19	1.84	↓ 35	2.00	↓ 40
Nitric oxide	µg/stick	13.0	500	↓ 97		
Nitro benzene	µg/stick	<0.011	<0.038	NA		
Nitrogen oxides	µg/stick	14.5	554	↓ 97		
N-nitrosoanabasine	ng/stick	2.3	31.1	↓ 93		
N-nitrosoanatabine	ng/stick	12.8	248	↓ 95		
NNN	ng/stick	7.0	274	↓ 97	184	↓ 96
o-Cresol	µg/stick	0.048	4.6	↓ 99		
o-Toluidine	ng/stick	0.94	102	↓ 99.1		
p-Cresol	µg/stick	0.047	9.8	↓ 99.5		
Phenol	µg/stick	0.953	17.1	↓ 94		
Propionaldehyde	µg/stick	12.0	108	↓ 89		
Propylene oxide	ng/stick	111	1066	↓ 90		
Pyrene	ng/stick	5.8	74.8	↓ 92		
Pyridine	µg/stick	6.22	26.8	↓ 77		
Quinoline	µg/stick	<0.011	0.45	↓ >98		
Resorcinol	µg/stick	<0.055	1.86	↓ >97		
Selenium	ng/stick	1.2	<4.42	NA		
Styrene	µg/stick	0.46	12.3	↓ 96		
Tar	mg/stick	19.5	24.8	↓ 21		
Toluene	µg/stick	1.28	137	↓ 99.1	149	↓ 99
Vinyl chloride	ng/stick	<2.19	92.5	↓ >98		
Water	mg/stick	35.6	15.3	↑ 133		
p-Menthan-3-ol	µg/stick	90.3	0.322	↑ 27943		
Propylene glycol	µg/stick	165	23.7	↑ 596		
Neomenthyl acetate	µg/stick	18.5	0.000	↑		
1-Hydroxy-2-propanone (1,2-Propenediol)#	µg/stick	131	96.8	↑ 35		
Benzyl alcohol	µg/stick	7.47	0.419	↑ 1683		
Menthone	µg/stick	3.87	0.189	↑ 1948		
2-Furanmethanol	µg/stick	47.1	9.13	↑ 416		
Trans-4-hydroxymethyl-2-methyl-1,3-dioxolane	µg/stick	1.92	0.044	↑ 4264		
2-Furancarboxaldehyde, 5-methyl-	µg/stick	9.10	2.84	↑ 220		
1-Butyl-2-isopropyl-5-methylcyclohexan-1-ol	µg/stick	1.43	0.000	↑		

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
Isomenthol	µg/stick	1.08	0.000	↑		
1,2,3-Propanetriol, diacetate (diacetyl)	µg/stick	2.23	0.381	↑ 485		
1-Hydroxy-2-butanone	µg/stick	0.842	0.465	↑ 81		
2-Cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)- (6,8-P-Menthadien-2-one)	µg/stick	0.831	0.057	↑ 1358		
Butyrolactone	µg/stick	2.94	0.728	↑ 304		
Menthofuran	µg/stick	0.524	0.012	↑ 4267		
2-Cyclopentene-1,4-dione	µg/stick	2.49	0.764	↑ 226		
Furfural	µg/stick	27.1	16.7	↑ 62		
2-Methylcyclobutane-1,3-dione	µg/stick	2.06	0.710	↑ 190		
1,2,3-Propanetriol, 1-acetate	µg/stick	1.98	0.696	↑ 184		
Ethyl vanillin	µg/stick	0.268	0.022	↑ 1118		
Bourbonene, beta-	µg/stick	0.237	0.064	↑ 270		
Cyclohexanone, 5-methyl-2-(1-methylethyl)-, cis- (D,L-isomenthone)	µg/stick	0.172	0.001	↑ 17100		
Butylated hydroxytoluene	µg/stick	0.154	0.007	↑ 2100		
Octanoic acid, 2-propenyl ester	µg/stick	0.140	0.000	↑		
Hexadecanoic acid, ethyl ester	µg/stick	0.162	0.008	↑ 1925		
1,2-Propanediol, 3-chloro-	µg/stick	5.39	7.08	↓ 24		
3-Octanol	µg/stick	0.103	0.000	↑		
Phenylacetaldehyde	µg/stick	1.14	0.529	↑ 116		
2-Furanmethanol, 5-methyl-	µg/stick	0.082	0.029	↑ 183		
2-Cyclohexen-1-one, 3-methyl-6-(1-methylethyl)- (P-Menth-1-en-3-one)	µg/stick	0.081	0.000	↑		
Maltoxazine	µg/stick	0.070	0.038	↑ 84		
2(5H)-Furanone	µg/stick	1.38	0.808	↑ 71		
3(2H)-Furanone, dihydro-2-methyl-	µg/stick	0.303	0.119	↑ 155		
Stearate, ethyl-	µg/stick	0.022	0.003	↑ 633		
Germacrene-D isomer	µg/stick	0.019	0.001	↑ 1800		

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
1,4-Dioxane, 2-ethyl-5-methyl-	µg/stick	0.018	0.0004	↑ 4400		
Ethyl linolenate	µg/stick	0.274	0.153	↑ 79		
Heneicosane, 2-methyl-	µg/stick	0.051	0.021	↑ 143		
Eicosane, 2-methyl-	µg/stick	0.033	0.014	↑ 136		
Copaene	µg/stick	0.003	0.002	↑ 50		
2-Formyl-1-methylpyrrole	µg/stick	0.095	0.064	↑ 48		
Cyclohexane, 1,2-dioxo-	µg/stick	0.061	0.046	↑ 33		
Glycidol	µg/stick	1.10	0.528	↑ 108		
Pyranone	µg/stick	7.72	5.84	↑ 32		
Pyranone	µg/stick	6.28	5.07	↑ 24		
Lanost-8-en-3-ol, 24-methylene-, (3beta)	µg/stick	5.22	1.61	↑ 224		
12,14-Labdadiene-7,8-diol, (8a,12E)	µg/stick	0.731	0.064	↑ 1042		
Menthol	µg/stick	0.296	0.000	↑		
Isolinderanolide	µg/stick	3.73	1.85	↑ 102		
Benzoic acid, 2,5-dihydroxy-methyl	µg/stick	4.04	2.18	↑ 85		
Ethyl 2,4-dioxohexanoate	µg/stick	5.85	3.57	↑ 64		
Isopulegone caffeate	µg/stick	0.107	0.001	↑ 10600		
Ergosterol	µg/stick	2.68	1.58	↑ 70		
Ethyl linoleate	µg/stick	0.060	0.008	↑ 650		
Labdane-8,15-diol, (13S)	µg/stick	0.071	0.015	↑ 373		
2H-Pyran-2-one, tetrahydro-5-hydroxy	µg/stick	4.09	3.11	↑ 32		
Isoquinoline, 3-methyl	µg/stick	6.30	4.99	↑ 26		
Diacetin	µg/stick	0.957	0.729	↑ 31		
5-Methylfurfural	µg/stick	0.813	0.632	↑ 29		
Pyridoxin	µg/stick	0.618	0.526	↑ 17		

Data Source: Section 3.3.2 and section 6.1.1.3.4 of the MRTPAs and Appendix A of an amendment to the MRTPAs submitted on December 8, 2017.

TABLE 3. COMPOUNDS IN MARLBORO FRESH MENTHOL *HEATSTICKS* COMPARED WITH REFERENCE CIGARETTE 3R4F AND MEAN OF 31 PMP S.A. CIGARETTES (“MODIFIED” HEALTH CANADIAN INTENSE)

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
1,3-Butadiene	µg/stick	0.192	93	↓ 99.8	117.0	↓ 99.8
1-Aminonaphthalene	µg/stick	0.060	21.7	↓ 99.7	32.1	↓ 99.8
2-Aminonaphthalene	µg/stick	0.031	17.0	↓ 99.8	20.1	↓ 99.8
3-Aminobiphenyl	µg/stick	0.009	4.5	↓ 99.8		
NNK	µg/stick	5.5	282	↓ 98	128	↓ 96
4-Aminobiphenyl	µg/stick	0.010	3.0	↓ 99.7	3.43	↓ 99.7
Acetaldehyde	µg/stick	192	1656	↓ 88	1467	↓ 87
Acetamide	µg/stick	2.9	14.2	↓ 79		
Acetone	µg/stick	38.7	658	↓ 94		
Acrolein	µg/stick	9.32	161	↓ 94	159	↓ 94
Acrylamide	µg/stick	1.68	5.0	↓ 66		
Acrylonitrile	µg/stick	<0.107	23.5	↓ >99.5	23.6	↓ >99.5
Ammonia	µg/stick	10.7	26.7	↓ 60	31.0	↓ 65
Arsenic	ng/stick	<1.20	<7.49	NA		
Benz[a]anthracene	ng/stick	1.51	25.6	↓ 94		
Benzene	µg/stick	0.473	73.5	↓ 99	87.0	↓ 99.5
Benzo[a]pyrene	ng/stick	0.448	14.4	↓ 97	15.3	↓ 97
Butyraldehyde	µg/stick	18.9	79.6	↓ 76		
Cadmium	ng/stick	0.31	104	↓ 99.7		
Carbon monoxide	mg/stick	0.480	33.3	↓ 99	28.0	↓ 98
Catechol	µg/stick	14.1	101	↓ 86		
Chromium	ng/stick	<11.0	<11.9	NA		
Crotonaldehyde	µg/stick	<3.29	49.9	↓ >93	51.1	↓ >94
Dibenz[a,h] anthracene	ng/stick	<0.124	1.02	↓ >88		
Ethylene oxide	µg/stick	0.125	15.7	↓ 99		
Formaldehyde	µg/stick	10.0	92.9	↓ 89	91.5	↓ 89
Glycerol	mg/stick	4.49	2.32	↑ 94		
Hydrogen cyanide	µg/stick	2.71	378	↓ 99		
Hydroquinone	µg/stick	6.48	92.9	↓ 93		
Isoprene	µg/stick	1.27	927	↓ 99.9	1005	↓ 99.9
Lead	ng/stick	<1.62	30.2	↓ >95		
m-Cresol	µg/stick	<0.019	4.1	↓ >99.5		
Menthol	mg/stick	2.42				
Mercury	ng/stick	1.89	4.1	↓ 54		
Methyl-ethyl-ketone	µg/stick	7.37	168	↓ 96		
Nickel	ng/stick	<15.9	<12.9	NA		

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
Nicotine	mg/stick	1.17	1.93	↓ 39	2.00	↓ 42
Nitric oxide	µg/stick	12.8	471	↓ 97		
Nitrobenzene	µg/stick	<0.011	<0.038	NA		
Nitrogen oxides	µg/stick	13.9	523	↓ 97		
N-nitrosoanabasine	ng/stick	2.19	33.9	↓ 94		
N-nitrosoanatabine	ng/stick	15.4	314	↓ 95		
NNN	ng/stick	7.75	274	↓ 97	184	↓ 96
o-Cresol	µg/stick	0.043	4.98	↓ 99		
o-Toluidine	ng/stick	0.98	106	↓ 99		
p-Cresol	µg/stick	<0.034	10.1	↓ >99.7		
Phenol	µg/stick	0.93	16.7	↓ 94		
Propionaldehyde	µg/stick	11.8	118	↓ 90		
Propylene oxide	ng/stick	119	921	↓ 87		
Pyrene	ng/stick	7.55	93.8	↓ 92		
Pyridine	µg/stick	6.05	27.0	↓ 78		
Quinoline	µg/stick	<0.011	0.410	↓ >97		
Resorcinol	µg/stick	<0.055	1.93	↓ >97		
Selenium	ng/stick	<0.83	<4.42	NA		
Styrene	µg/stick	0.46	11.9	↓ 96		
Tar	mg/stick	18.1	28.5	↓ 36		
Toluene	µg/stick	1.03	119	↓ 99	149	↓ 99
Vinyl chloride	ng/stick	<0.66	101	↓ >99		
Water	mg/stick	36.0	14.5	↑ 148		
p-Menthan-3-ol	µg/stick	365	1.39	↑ 26159		
Propylene glycol	µg/stick	299	61.9	↑ 383		
2-Furanmethanol	µg/stick	41.6	6.16	↑ 575		
Hexadecanoic acid, ethyl ester	µg/stick	6.65	0.603	↑ 1003		
1,2,3-Propanetriol, 1-acetate	µg/stick	20.1	5.03	↑ 300		
Menthyl acetate	µg/stick	5.76	0.086	↑ 6598		
2-Cyclopentene-1,4-dione	µg/stick	15.5	3.92	↑ 295		
1-Hydroxy-2-propanone (1,2-Propenediol)#	µg/stick	123	77.7	↑ 58		
5-Methylfurfural	µg/stick	10.1	2.94	↑ 244		
Trans-4-hydroxymethyl-2-methyl-1,3-dioxolane	µg/stick	1.61	0.075	↑ 2047		
Furfural	µg/stick	20.0	12.6	↑ 59		

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
Menthone	µg/stick	1.59	0.018	↑ 8733		
1,2-Propanediol, 3-chloro-	µg/stick	8.25	1.44	↑ 473		
Butyrolactone	µg/stick	3.55	0.861	↑ 312		
Isomenthol	µg/stick	0.776	0.000	↑		
2-Cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)- (6,8-p-menthadien-2-one)	µg/stick	0.365	0.009	↑ 3956		
Stearate, ethyl-	µg/stick	0.361	0.011	↑ 3182		
1,2,3-Propanetriol, diacetate (diacetin)	µg/stick	3.76	1.59	↑ 136		
Phenylacetaldehyde	µg/stick	1.66	0.576	↑ 188		
Benzyl alcohol	µg/stick	5.49	4.16	↑ 32		
Octanoic acid, 2-propenyl ester	µg/stick	0.212	0.000	↑		
Cyclohexanol, 5-methyl-2-(1-methylethenyl)- (menth-8-en-3-ol)	µg/stick	0.325	0.028	↑ 1061		
Ethyl vanillin	µg/stick	0.182	0.010	↑ 1720		
2(5H)-furanone	µg/stick	2.28	1.06	↑ 115		
Menthofuran	µg/stick	0.158	0.007	↑ 2157		
Butylated hydroxytoluene	µg/stick	0.149	0.009	↑ 1556		
2-Cyclohexen-1-one, 3-methyl-6-(1-methylethyl)- (piperitone)	µg/stick	0.124	0.005	↑ 2380		
Bourbonene, beta-	µg/stick	0.118	0.047	↑ 151		
Higher molecular weight menthol derivative	µg/stick	0.109	0.000	↑		
2-Propanone, 1-(acetyloxy)-	µg/stick	9.68	6.62	↑ 46		
Menthofuran derivative	µg/stick	0.158	0.013	↑ 1115		
3(2H)-Furanone, dihydro-2-methyl-	µg/stick	1.12	0.489	↑ 129		
3-Cyclohexene-1-methanol, ?,?,4-trimethyl- (terpineol)	µg/stick	0.082	0.004	↑ 1950		
Pyranone	µg/stick	7.82	5.42	↑ 44		
2-Furanmethanol, tetrahydro-	µg/stick	0.104	0.014	↑ 643		
Menthone isomer	µg/stick	0.051	0.002	↑ 2450		
4(H)-Pyridine, N-acetyl-	µg/stick	0.287	0.164	↑ 75		
Eicosane, 2-methyl-	µg/stick	0.158	0.081	↑ 95		

COMPOUND	UNIT	NEW PRODUCT	3R4F	CHANGE (%) WITH 3R4F ON STICK BASIS	US MARKET	CHANGE (%) WITH US MARKET ON STICK BASIS
1,2-Cyclohexanedione	µg/stick	0.307	0.194	↑ 58		
Eicosane, 3-methyl-	µg/stick	0.053	0.026	↑ 104		
2,3-Dihydro-5-hydroxy-6-methyl-4H-pyran-4-one (dihydromaltol)	µg/stick	0.421	0.304	↑ 38		
Germacrene-D	µg/stick	0.164	0.110	↑ 49		
Glycidol	µg/stick	1.08	0.456	↑ 137		
Ethyl linolenate	µg/stick	2.05	0.429	↑ 378		
Ethyl linoleate	µg/stick	0.565	0.032	↑ 1666		
12,14-Labdadiene-7,8-diol, (8a,12E)	µg/stick	8.68	0.322	↑ 2596		
Lanost-8-en-3-ol, 24-methylene-, (3beta)	µg/stick	8.06	1.65	↑ 388		
Isolinderanolidide	µg/stick	7.37	1.98	↑ 272		
Ethyl 2,4-dioxohexanoate	µg/stick	8.91	3.72	↑ 140		
Benzoic acid, 2,5-dihydroxy-methyl	µg/stick	5.23	1.87	↑ 180		
Menthol	µg/stick	0.592	0.000	↑		
Ergosterol	µg/stick	3.54	1.33	↑ 166		
Pyranone	µg/stick	6.89	3.92	↑ 76		
2H-Pyran-2-one, tetrahydro-5-hydroxy	µg/stick	5.41	2.94	↑ 84		
Labdane-8,15-diol, (13S)	µg/stick	0.175	0.009	↑ 1844		
5-Methylfurfural	µg/stick	1.91	1.00	↑ 91		
Anatabine	µg/stick	15.6	12.0	↑ 30		
Diacetin	µg/stick	1.83	1.04	↑ 76		
Pyridoxin	µg/stick	0.898	0.498	↑ 80		
(S)-cis-Verbenol	µg/stick	1.05	0.771	↑ 36		
Oleoylglycine	µg/stick	1.09	0.875	↑ 25		
Tyrosine, 3-hydroxy	µg/stick	2.82	2.42	↑ 17		
5,7-Dimethoxycoumarin	µg/stick	1.81	1.59	↑ 14		
Glycidyl acetate	µg/stick	0.178	0.140	↑ 27		

Data Source: Section 3.3.2 and section 6.1.1.3.4 of the MRTPAs and Appendix A of an amendment to the MRTPAs submitted on December 8, 2017.