Table 1 Chemicals that have been reported to occur in cigarette smoke (listed alphabetically), with cancer classifications, cancer potency unit risk factors and non-cancer reference exposure levels

Table width=A

	Chemical	**IARC group***	**Cal/EPA Cancer potency unit risk‡** $(\mu g/m^3)^{-1}$	**USEPA Cancer potency unit risk** $(\mu g/m^3)^{-1}$	**Non-cancer REL and target organ** $(\mu g/m^3)$	**Mainstream yields—ISO** (μg/cigarette)
1	1-Aminonaphthalene[3]					0.0096
2	2-Aminonaphthalene[3]	1	5.14E–04			0.007
3	3-Aminobiphenyl[3]					0.0017
4	3-Ethenylpyridine[13]					662
5	4-Aminobiphenyl[3]	1	6.00E–03			0.0012
6	Acetaldehyde[3]	2B	2.70E–06	2.20E-06	9 (resp)	680
7	Acetamide[14]	2B	2.00E–05			47
8	Acetic acid[14]					550
9	Acetone[3]					287
10	Acrolein[3]	3			0.02 (resp/eye)	68.8
11	Acrylonitrile[3]	2B	2.90E–04	6.80E–05	2 (resp)	8.9
12	Ammonia[3]				100 (resp)	12.2
13	Aniline[14]	3			1 (immune)	0.25

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ ($\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk ($\mu g/m^3)^{-1}$	Non-cancer REL and target organ ($\mu g/m^3$)	Mainstream yields—ISO (μg/cigarette)
14	o-Anisidine[14]	2B				
15	Anthanthrene[14]	3				0.012
16	Anthracene[14]	3				0.13
17	Arsenic[15]	1	3.30E–03	4.30E–03	0.03 (dev/card/nerv) CEPA only	0.7
18	Benz[a]acridine[14]	3				
19	Benz[c]acridine[14]	3				
20	Benz(a)anthracene[13]	2A	1.10E–04			0.045
21	Benzene[3]	1	2.90E–05	7.80E–06	60 (30) (dev/card/nerv/immune)	46.3
22	Benzo[a]fluorene[14]	3				0.11
23	Benzo[b]fluorene[14]	3				0.02
24	Benzo[c]fluorene[14]	3				

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ $(\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk $(\mu g/m^3)^{-1}$	Non-cancer REL and target organ $(\mu g/m^3)$	Mainstream yields—ISO (μg/cigarette)
25	Benzo[g,h,i]perylene[14]	3				0.06
26	Benzo[c]phenanthrene[14]	3				
27	Benzo(a)pyrene[14]	2A	1.10E–03			0.035
28	Benzo[e]pyrene[14]	3				0.016
29	Benzo(b)fluoranthene[14]	2B	1.10E–04			0.03
30	Benzo(j)fluoranthene[14]	2B	1.10E–04			0.06
31	Benz(k)fluoranthene[16]	2B	1.10E–04			0.009
32	Benzo[g,h,i]fluoranthene[14]	3				0.0025

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ $(\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk $(\mu g/m^3)^{-1}$	Non-cancer REL and target organ $(\mu g/m^3)$	Mainstream yields—ISO (μg/cigarette)
33	Beryllium[15]	1	2.40E–03	2.40E–03		0.00025
34	Bicyclohexyl[14]					
35	1,3 – Butadiene[3]	2A	1.70E–04	3.00E–05	8 (repro/dev)	35.5
36	Butyraldehyde[3]					32.4
37	Butyrolactone [14]	3				10
38	Cadmium[3]	1	4.20E–03	1.80E–03	0.01 (kidney/resp)	0.103
39	Captan[14]	3				17
40	Carbazole[14]	3				1
41	Carbon Monoxide[3,17,18]				10,000 (card)	13,609
42	Catechol[3]	2B				88.2
43	Chlorinated dioxins and furans[9]§	1	3.7E+01		0.00004 (dev/immune/resp/end/alimentary)	0.000001

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ ($\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk ($\mu g/m^3)^{-1}$	Non-cancer REL and target organ ($\mu g/m^3$)	Mainstream yields—ISO (μg/cigarette)
44	Cholesterol[14]	3				22
45	Chromium (hexavalent)[3]	1	1.50E–01	1.20E–02	0.0008 (resp)	0.0042
46	Chrysene[13,14]	3	1.10E–05			0.05
47	Coronene[14]	3				0.001
48	Coumarin[14]	3				
49	Crotonaldehyde[3]	3				14.2
50	Cyclohexane[14]					
51	Cyclopentane[14]					
52	DDT[14]	2B	9.71E–05	9.70E–05		0.95
53	Dibenz(a,h)acridine[13]	2B	1.10E–04			0.0001
54	Dibenz(a,j)acridine[13]	2B	1.10E–04			0.0027
55	Dibenz[a,c]anthracene[14]	3				
56	Dibenz(a,h)anthracene[13]	2A	1.20E–03			0.004

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ ($\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk ($\mu g/m^3)^{-1}$	Non-cancer REL and target organ ($\mu g/m^3$)	Mainstream yields—ISO (μg/cigarette)
57	Dibenz[a,j]anthracene[14]	3				0.01
58	7H-Dibenzo(c,g)-carbazole[13]	2B	1.10E–03			0.0007
59	Dibenzo[a,e]fluoranthene[14]	3				
60	Dibenzo[a,e]pyrene[14]	2B				
61	Dibenzo(a,i)pyrene[15,14]	2B	1.10E–02			0.0025
62	Dibenzo(a,l)pyrene[14]	2B	1.10E–02			
63	Dimethylamine[14]					
64	1,1-Dimethylhydrazine[14]	2B				
65	2,3-Dimethylmaleic anhydride[14]					

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ ($\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk ($\mu g/m^3)^{-1}$	Non-cancer REL and target organ ($\mu g/m^3$)	Mainstream yields—ISO (μg/cigarette)
66	1,4-Dimethylphenanthrene[14]	3				
67	2,5-Dimethylpyrazine[14]					11.2
68	Endrin[14]	3				
69	Ethylamine[14]					1.2
70	Ethylbenzene[17]	2B			1000 (dev/aliment /kidney)	
71	Ethylene[14]	3				300
72	Eugenol[14]	3				3
73	Fluoranthene[14]	3				0.18
74	Fluorene[14]	3				
75	Formaldehyde[3]	2A	6.00E–06	1.30E–05	2 (resp/eyes)	33.0
76	Formic acid[14]					340
77	Furfural[14]					77

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ ($\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk ($\mu g/m^3)^{-1}$	Non-cancer REL and target organ ($\mu g/m^3$)	Mainstream yields—ISO (μg/cigarette)
78	Hydrazine[14]	2B	4.90E–03	4.90E–03	0.2 (aliment/end)	0.034
79	Hydrogen cyanide[3]				3 (card)	118.4
80	Hydrogen sulphide[16]				0.9 (resp)	
81	Hydroquinone[3]	3				72.2
82	Indeno(1,2,3-c,d)pyrene[15, 14]	2B	1.10E–04			0.012
83	Isoprene[3]	2B				264
84	Lead[3]	2B	1.20E–05			0.0128
85	m-+p-Cresol[3]				4 (card)	14
86	Malathion[14]	3				
87	Maleic hydrazide[14]	3				1.1
88	Mercury[3]				0.3 (nerv)	0.0052
89	Methanol[14]	3				135
90	Methyl acrylate[14]	3				
91	Methyl catechol[14]					38
92	Methyl chloride[14]					495

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ $(\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk $(\mu g/m^3)^{-1}$	Non-cancer REL and target organ $(\mu g/m^3)$	Mainstream yields—ISO (μg/cigarette)
93	1-Methylchrysene[14]	3				0.003
94	2-Methylchrysene[14]	3				0.001
95	3-Methylchrysene[14]	3				0.006
96	4-Methylchrysene[14]	3				
97	5-Methylchrysene[15, 14]	2B	1.10E–03			0.0006
98	6-Methylchrysene[14]	3				0.007
99	Methyl ethyl ketone[3]				1000 (repro)	54.8
100	Methylamine[14]					4.8
101	2-Methylfluoranthene[14]	3				
102	3-Methylfluoranthene[14]	3				
103	1-Methylphenanthrene[14]	3				0.03
104	Methyl isocyanate[14]					3.3
105	Methylpyrazines [14]					1.2
106	2-Methylpyridine[14]					
107	3-Methylpyridine[14]					

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ ($\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk ($\mu g/m^3)^{-1}$	Non-cancer REL and target organ ($\mu g/m^3$)	Mainstream yields—ISO (μg/cigarette)
108	4-Methylpyridine[14]					
109	1-Methylpyrrolidine[14]					3
110	Nickel[3]	1	2.60E–04	2.40E–04	0.05 (resp/immune)	0.011
111	Nicotine[3]					810
112	Nitric oxide[3]					37.7
113	Nitrogen dioxide[14]				20 (resp)	350
114	1-Nitro-N-butane[14]					0.80
115	Nitroethane[14]					1.2
116	Nitromethane[14]					0.62
117	1-Nitro-N-pentane[14]					0.20
118	1-Nitropropane[14]					0.79
119	2-Nitropropane[14]	2B				0.97
120	N-Nitrosoanabasine (NAB)[14]	3				0.1
121	N-Nitrosoanatabine (NAT)[14]	3				1.9

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ ($\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk ($\mu g/m^3)^{-1}$	Non-cancer REL and target organ ($\mu g/m^3$)	Mainstream yields—ISO (μg/cigarette)
122	4-N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)[14]	2B				0.39
123	N-Nitroso-N-dibutylamine [14]	2B	3.14E–03	1.60E–03		0.012
124	N-Nitrosodiethanolamine[13]	2B	8.00E–04			0.03
125	N-Nitrosodiethylamine (NDEA)[13]	2A	1.03E–02	4.30E–02		0.0083
126	N-Nitrosodimethylamine (NDMA)[13]	2A	4.57E–03	1.40E–02		0.0244
127	N-Nitrosoethyl-methylamine[15]	2B	6.29E–03			0.006

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ ($\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk ($\mu g/m^3)^{-1}$	Non-cancer REL and target organ ($\mu g/m^3$)	Mainstream yields—ISO (μg/cigarette)
128	N-Nitrosomorpholine[14]	2B	1.91E–03			
129	N-Nitrosonornicotine (NNN)[13]	2B	4.00E–04			1.9
130	N Nitrosopiperidine[14]	2B	2.69E–03			0.0045
131	N-Nitroso-N-propylamine[14]	2B	2.00E–03			0.0005
132	N-Nitrosopyrrolidine (NP)[13]	2B	6.00E–03	6.10E–04		0.113
133	O–Cresol[3]				4 (card)	5.7
134	Particulate matter					
135	Perylene[14]	3				0.004
136	Phenanthrene[14]	3				0.35
137	Phenol[3]				600 (aliment/card/ kidney/nerv)	26.1

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ ($\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk ($\mu g/m^3)^{-1}$	Non-cancer REL and target organ ($\mu g/m^3$)	Mainstream yields—ISO (μg/cigarette)
138	N-Phenyl-2-naphthylamine[14]	3				
139	Polonium-210[13]					
140	Propionaldehyde[3]					49.8
141	Propylene[14]					75
142	Pyrene[14]	3				0.13
143	Pyridine[3]	3				11.8
144	Pyrrole[17]					
145	Pyrrolidine[14]					0.16
146	Resorcinol[14]					44
147	Quinoline[3]					0.356
148	Selenium[14]	3			0.08 (resp)	
149	Styrene[3]	2B			1000 (nerv)	5.71
150	Succinic anhydride[14]					
151	Toluene[3]				400 (dev/nerv/ aliment)	72.8
152	2-Toluidine[13]	2A				0.115

	Chemical	IARC group*	Cal/EPA Cancer potency unit risk‡ $(\mu g/m^3)^{-1}$	USEPA Cancer potency unit risk $(\mu g/m^3)^{-1}$	Non-cancer REL and target organ $(\mu g/m^3)$	Mainstream yields—ISO (μg/cigarette)
153	Trimethylamine[14]					0.7
154	Triphenylene[14]	3				
155	Urethane[19]	2B	2.86E–04			0.029
156	Vinyl acetate[20]	2B			200 (resp)	
157	Vinyl chloride[14]	1	7.80E–05	4.40E–06		0.0086
158	Xylenes[17]				200 (nerv/resp)	

†1, known human carcinogens; 2A, probable human carcinogens; 2B, possible human carcinogens; 3, unclassifiable as a human carcinogen

‡Unit risks are those reported by the California EPA www.oehha.ca.gov, or the USEPA www.epa.gov/iris.[5, 11] The non-cancer RELs and RfDs from Cal/EPA and USEPA are identical with the exception of benzene and arsenic.

The values from reference[3] were obtained through taking the average yield from 11 leading brands reported on the British Columbia Ministry of Health website in 2000. Brands included: du Maurier King Size; du Maurier Light King Size; du Maurier Regular; Player's Regular; Player's Light Regular; Player's Extra Light Regular; Player's Light King Size; Matinee Extra Mild King Size; Rothman's King Size; Export A Regular; Export A Light Regular.

§this potency is presented but was not used in the final analysis as dioxins were assumed to not be non-threshold carcinogens and inappropriate for the current analysis resp, respiratory system; repro/dev, reproductive or developmental processes; aliment, alimentary system (GI tract, liver); immune, immune system; card, cardiovascular system; nerv, nervous system; end, endocrine system