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*Material Emission Information from
105 Building Materials and Consumer Products*

Doyun Won and Wenping Yang

Prepared for: Health Canada

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Material Emission Information from 105 Building Materials and Consumer Products

Summary

This report summarizes the emission factors of 72 volatile organic compounds (VOCs) from 105 household materials tested under the “material emissions testing for naphthalene” (B3333) in 2010 and 2011. The test specimens included 61 building materials/furnishings and 44 consumer products. The tests were conducted using a fast screening method in a micro-scale chamber system in accordance with ASTM standard D7706–11. In addition to air samples taken for the naphthalene emission characterization, one more air sample was taken at 1.5 hour during the 2 hour test period. The additional sample was analyzed in a full-scan mass spectrometry (MS) mode for a broader range of VOCs. The special focus of this report was on determining the presence of 17 chemicals that are currently designated as “priority chemicals” by Health Canada’s Indoor Air Contaminants Assessment Section.

Among 72 NRC target compounds, **alkaloids** (detection frequency: 0 %) and **halogenated compounds** (~4 %) were rarely detected with an exception of **1,4-dichlorobenzene** (34 %). On average, the detection frequencies were:

- **Glycol ethers:** < 10 %
- **Esters:** < 20 %
- **Alcohols/aldehydes/ketones:** < 30 %
- **Aliphatic hydrocarbons:** ~ 30%
- **Terperens:** ~ 40 %

The **aromatic** hydrocarbons had the highest detection frequency (66% on average).

The compounds with a detection frequency > 50 % were

- **Phenol** (alcohols),
- **Acetone, 2-butanone** (aldehyes & ketones),
- **Decane, dodecane, nonane, undecane** (aliphatic HCs),
- **Dimethylbenzenes** (1,2- & 1,3(4)-), **trimethylebenzenes** (1,2,3-, 1,2,4- & 1,3,5-),
ethyltoluenes (2-, 3- & 4-), **benzene, styrene** and **ethylbenzene** (aromatic HCs),
- **α-Pinene, limonene** (terpenes).

Compounds in the same chemical group showed high correlations among themselves, indicating that compounds with similar properties were generally emitted together. Comparison to the past emission data indicated a potential shift of product formulations from aliphatic hydrocarbons and halogenated compounds to oxygenated compounds such as alcohols, glycol ethers and esters.

Among the 17 “priority chemicals”, no information was produced for 6 compounds (**acrolein, acetaldehyde, ethylene oxide, propanal, 1,3-butadiene, and propylene oxide**) since they were not compatible with sorbent sampling on Tenax TA or Carbotrap 300 and subsequent thermal desorption method. Four aromatic compounds (**benzene, ethylbenzene, 1,2-dimethylbenzene** and **1,3(4)-dimethylbenzene**) generally showed high detection frequencies (> 65 %) and high correlations among themselves. Among these compounds, benzene was emitted

in low concentrations, leading to only 20 % of detected levels above the method detection limit.

On the contrary to the four aromatic compounds detected in almost all materials tested, **1,4-dichlorobenzene** and **dichloromethane** were detected less frequently (34 % and 6 %, respectively) and were mostly from non-building materials, including wooden furniture, vinyl furniture, foam products, deodorant blocks for closet and toilet, incense, candle and moth ball. Other chlorinated “priority chemicals”, including **tetrachloroethylene**, **1,2-dichloroethane**, **chloroform**, **carbon tetrachloride**, **1,1,2,2-tetrachloroethane**, were not detected in any test. **2-Propanol** was emitted from 19 % of materials, among which wooden furniture was the most noticeable material category.

In spite of the limitations of the study (e.g., only a single air sample collected at 1.5 hour during the 2 hour emission test), the results are expected to provide valuable information for the identification of indoor sources of 72 VOCs.

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1 Introduction

Indoor air contains hundreds of volatile organic compounds most of which are in the ppb range (Dawson and McAlary, 2009), leading to continuous and low level exposure to potentially harmful organic compounds. Identifying the sources of numerous VOCs indoors is necessary for better source control in spite of its difficulties. In 2010 and 2011, a total of 105 household materials were tested to identify major sources of naphthalene in Canadian homes under the project “material emissions testing for naphthalene” (B3333). A fast screening method using a micro-scale chamber was used in accordance with ASTM standard D7706–11 (ASTM, 2010). The method has an advantage of rapid equilibrium establishment (Kang et al., 2012), leading to a shorter experimental time and less consumption of resources.

During the tests, four air samples were taken at 0.5, 1, 1.5 and 2 hours. The GC/MS analysis for the air samples at 0.5, 1 and 2 hours was done in selected ion monitoring (SIM) mode with a target ion of m/z 128, which was optimized for the maximum sensitivity of naphthalene. The results were reported in Kang et al. (2012). The full characterization of these samples for other compounds was sacrificed for the improved sensitivity of naphthalene. Additionally, the samples taken at 1.5 hours were analyzed in full scan mode (SCAN), for a wide range of compounds (m/z 35 to 300), including 72 VOCs of the NRC target list.

This report summarizes the emission factors of the 72 VOCs based on the full scan data of 105 household materials. The particular focus is on the subset of 17 chemicals that are currently designated as “priority chemicals” by Health Canada’s Indoor Air Contaminants Assessment Section, including benzene, isopropyl alcohol (2-propanol), tetrachloroethylene, 1,2-dichloroethane, chloroform, 1,4-dichlorobenzene, dichloromethane, carbon tetrachloride, 1,1,2,2-tetrachloroethane and xylenes (1,2-dimethylbenzene and 1,3(4)-dimethylbenzene).

2 Methods

2.1 Test specimens

The test materials were purchased randomly in several retail outlets in Ottawa between November and December 2010. The chamber tests were conducted between December 2010 and February 2011. While the material selection was focused on identifying sources of naphthalene, the final list includes a wide range of building materials and consumer products that can be found in typical Canadian homes and that can be sources of other VOCs.

Table 1 summarizes the test specimens that belong to the building materials & furnishings category, while Table 2 lists those for the consumer product category. A total of 50 building materials were tested, including vinyl flooring (# of specimens: 2), carpet (2), area mat (2), under-pad (2), flooring/adhesive composite (4), cement-containing product (2), paint (6), primer (5), wax (1), wood stain (2), varnish (4), caulking (10), adhesive (8). Furnishings were wooden furniture (6) and vinyl furniture cover (5). A total of 44 consumer products were tested, including foam mats (2), foam toys (4), incenses (3), candles (8), air freshener (7), deodorant blocks (3), moth balls (2), cleaning products (5) and coal tar shampoos (3). More

detailed descriptions of the test materials can be found in the appendix (A.1 Test materials and products).

Table 1: Test materials – building materials and furnishings

Category	Subcategory	Detailed subcategory	Test ID	Test mode
Building material (50) ^a	Flooring (8) ^a	Vinyl flooring (2) ^a	VF1, 2	Cell
		Carpet (4)	CRP1, 2	"
		Area mat (2)	CRP3, 4	"
		Under pad (2)	UP1, 2	"
	Composite (4)	Flooring/adhesive (4)	ADH2CRP2, ADH3GB, ADH6LF, ADH8VF1	"
	Cement (2)	Cement board (1)	CB1	Cell (glass disc)
		Solvent cement (1)	CEM1	"
	Paint (6)	Oil-based (3)	PAT1, 4, 5	"
		Water-based (3)	PAT2, 3, 6	"
	Primer (5)	Oil-based (4)	PRM1, 2, 4, 5	"
		Water-based (1)	PRM3	"
	Coating (7)	Wax (1)	WAX1	"
		Wood stain (2)	STA1, 2	"
		Varnish (4)	VAR1 - 4	"
	Caulking (10)	Window/door (3)	CAK1, 2, 5	"
		Kitchen/bath (2)	CAK4, 6	"
		Roof (1)	CAK3	"
		Multi-purpose (4)	CAK7 – 10	"
	Adhesive (8)	Flooring adhesive (4)	ADH1, 2, 6, 8	"
		Tile adhesive (2)	ADH3, 4	"
		Multi-purpose (2)	ADH5, 7	"
Furnishing (11)	Wooden furniture (6)	Wooden furniture panel (6)	FUR1- 6	Cell
	Vinyl furniture (5)	Vinyl chair cushion cover (5)	FRU7-11	"

^a The number of specimens tested within the category

Table 2: Test materials – consumer products

Category	Subcategory	Detailed subcategory	Test ID	Test mode
Consumer product (44) ^a	Foam (6) ^a	Foam mat (2) ^a	FOM1, 2	Cell
		Foam toy (4)	FOM3 – 6	"
	Incense (3) Candle (8) Air freshener (7)	Incense stick (3)	INS1 - 3	Bulk
		Scented candle (5)	CDN1 - 4, 6	"
		Unscented candle (2)	CDN5, 7	"
		Oil lamp (1)	CDN8	"
		Scented oil plug-in (2)	AF1, 2	"
		Scented gel (2)	AF6 – 7	"
		Liquid fragrance diffuser (1)	AF3	"
		Scented reed diffuser (2)	AF4, 5	"
		Deodorant block (3)	DOE1, 2	"
		Toilet & garbage can (1)	DOE3	"
	Moth preventative (2)	Moth ball (2)	MB1 – 2	"
	Art paint (7) Cleaning product (5)	Art oil paint (3)	AOP1 – 3	"
		Oil paint thinner (2)	OPT1, 2	"
		Oil paint varnish (2)	OPV1, 2	"
		Degreaser (3)	CL2 – 4	"
		Multi-purpose cleaner (2)	CL1, 5	"
	Shampoo (3)	Coal tar shampoo (3)	SHP1 - 3	"

^a The number of specimens tested within the category

2.2 Test procedures and analysis

A fast screening method using the micro-chamber/thermal Extractor (μ -CTE, Markes Internal) was carried out in accordance with ASTM standard D7706–11 (ASTM, 2010). The six chambers of μ -CTE system were placed in an adjustable heated block. Clean air from Aadco Model 737 Pure Air Generator was supplied to each chamber via a gas restrictor. The test conditions were 0 % RH, 23 °C and 50 mL/min of air flow rate. The clean air entered at the top of each chamber and the exhaust flow was collected through an adsorption tube attached to the exhaust port.

Depending on the type of specimen, two different testing modes were used. For the surface emission testing, the specimen was cut into a circular shape with a diameter of approximately 45 mm a couple of hours before a test. The disc-shaped test specimen was raised using a spacer until the emitting surface forms one wall of a reduced-volume chamber. This mode restricted the specimen to emit only from the surface eliminating interferences from edges and rear surfaces. Liquid building materials such as paint were applied on a glass disc and tested in the same cell mode.

If the surface emission testing mode was not applicable due to the nature of the specimen (e.g., irregular shape), the bulk emission testing mode was used. For the bulk emission testing a specimen was placed into a chamber and the entire specimen was exposed to the chamber air. In this mode, clean air passed around the specimen with emitted chemicals being swept from the chamber and collected onto the tube. Most of solid and liquid consumer products were tested in the bulk mode as shown in Table 2. To prevent direct contact between a specimen and chamber wall, a Petri dish-type glass container was used as specimen holder for the bulk mode test.

Table 3 summarizes the test parameters for the micro-scale and small-scale chamber. It should be noted that the air change rate is very high compared to the conventional small-scale chamber method that uses the air exchange rate of 1 /h. The high air exchange rate is due to the reduced chamber size to facilitate a rapid equilibrium that allows the reduction of testing time and cost compared to the conventional method. However, the resulting specific air flow of $2.5 \text{ m}^3/\text{m}^2/\text{h}$ was similar to that of the conventional method that typically uses an air change rate of 1 /h and the loading ratio of $0.4 \text{ m}^2/\text{m}^3$.

Table 3: Test parameters of the micro-scale (MS) and small-scale (SS) chamber

Parameter	Micro-scale (cell mode)	Micro-scale (bulk mode)	Small-scale
Diameter (mm)	40	45	N/A
Depth (mm)	2.5	10	N/A
Volume (m^3)	3.14×10^{-6}	1.59×10^{-5}	5.00×10^{-2}
Exposed surface area (m^2)	1.25×10^{-3}	N/A ^a	N/A ^a
Equilibration time (min)	30	30	1440
Sampling time (min)	10	10	10
Inlet air flow rate (cm^3/min)	50	50	800
Air change rate (1/h)	~1000	~190	1
Specific air flow ($\text{m}^3/\text{m}^2/\text{h}$)	2.5	N/A	2.4

^a N/A: not available

Air samples were collected on sorbent tubes (Tenax TA) for 10 min at 0.5, 1, 1.5 and 2 hours. The three samples at 0.5, 1 and 2 hours were thermally desorbed with a Gerstel thermal desorption unit (TDS-3) and analyzed with a Varian 4000 Gas Chromatograph – Ion Trap Mass Spectrometer (Varian GC-MS). Since the focus of the research was to identify sources of naphthalene, the MS was operated in the selected ion monitoring (SIM) mode with a target ion of m/z 128, allowing the maximized sensitivity for naphthalene. More detailed information on naphthalene emissions from these samples can be found in Kang et al. (2012) and Won et al. (2011).

The samples collected at 1.5 hours were thermally desorbed with a Gerstel thermal desorption unit (TDS-3) and analyzed with an autosampler (TDS-A) connected to an Agilent 6890 Gas Chromatograph / 5973N Mass Selective Detector equipped with a SPB-624 capillary

column ($30\text{ m} \times 0.25\text{ mm I.D.} \times 1.4\text{ }\mu\text{m thickness}$). The MS was operated in full scan mode (m/z 35 to 300) to obtain the information for all compounds contained in the sample. The desorbed analytes were injected using a programmable temperature vaporizer called as Cooled Injection System (CIS). The Gerstel system was operated in the TDS splitless / CIS split mode (split ratio of 30:1 for dry materials and 100:1 for wet materials) and the MS was operated in the full scan mode.

Temperature profiles for the thermal desorption and GC-MS analysis are as follows:

- Thermal desorption condition: an initial temperature of $30\text{ }^{\circ}\text{C}$ to a final temperature $300\text{ }^{\circ}\text{C}$ with a rate of $60\text{ }^{\circ}\text{C/min}$ with a holding time of 5 min at the end.
- CIS condition: an initial temperature of $-90\text{ }^{\circ}\text{C}$ to a final temperature of $350\text{ }^{\circ}\text{C}$ with a rate of $12\text{ }^{\circ}\text{C/s}$ with a holding time of 3 min at the end.
- GC condition: an initial temperature of $35\text{ }^{\circ}\text{C}$ holding 6 min to a temperature $230\text{ }^{\circ}\text{C}$ with a rate of $6\text{ }^{\circ}\text{C/min}$.

We used two types of mode for the MS operation to find the optimum between maximizing the sensitivity for naphthalene and obtaining the full characterization of the samples, within the given constraints of time and resources. The presence of 72 compounds from the NRC target list was examined using the chromatograms and spectra from the 1.5-h samples. A peak from a volatile substance was indentified by comparing its mass spectrum with its target ions identified by the Supelco customized liquid solution, and quantified through a 5-point calibration of its authentic compund in the calibration solution. The detection limits of the compound are given in Table 4.

The emission factor at 1.5 h was calculated using the following equation:

$$E = \frac{CQ}{A}$$

where

E is the emission factor ($\mu\text{g/m}^2/\text{h}$ or $\mu\text{g/g/h}$)

C is the chamber air concentration ($\mu\text{g/m}^3$)

Q is the chamber flow rate (m^3/h)

A is the specimen surface area or weight (m^2 or g)

Table 4: Method detection limits of 72 NRC IAQ target compounds

#	Class	CAS#	Compound	MW	BP (°C)	MDL (ng)
1	Alcohols	71-36-3	1-Butanol	74.1	117.8	2.07
2		71-23-8	1-Propanol	60.1	97.4	1.61
3		104-76-7	2-Ethyl-1-hexanol	130.2	183.0	3.95
4		67-63-0	2-Propanol	60.1	82.4	1.42
5		64-17-5	Ethanol	46.1	78.4	1.48
6		108-95-2	Phenol	94.1	182.0	3.31
7	Aldehydes & ketones	78-93-3	2-Butanone	72.1	79.8	0.94
8		108-10-1	4-Methyl-2-pentanone	100.2	116.7	1.13
9		67-64-1	Acetone	58.1	56.4	3.43
10		100-52-7	Benzaldehyde	106.1	179.2	1.17
11		123-72-8	Butanal	72.1	75.0	0.69
12		112-31-2	Decanal	156.3	215.2	0.67
13		111-71-7	Heptanal	114.2	152.8	0.50
14		66-25-1	Hexanal	100.1	119.0	0.30
15		124-19-6	Nonanal	142.2	195.2	1.29
16		110-62-3	Pentanal	86.1	103.0	0.76
17	Aliphatic hydrocarbons	540-84-1	2,2,4-Trimethylpentane	114.2	99.3	5.22
18		108-08-7	2,4-Dimethylpentane	100.2	80.0	5.99
19		124-18-5	Decane	142.3	174.3	0.58
20		112-40-3	Dodecane	170.3	216.5	0.56
21		142-82-5	Heptane	100.2	98.6	2.35
22		544-76-3	Hexadecane	226.4	287.0	1.32
23		110-54-3	Hexane	86.2	68.9	
24		111-84-2	Nonane	128.3	151.0	0.68
25		111-65-9	Octane	114.2	125.8	0.84
26		629-62-9	Pentadecane	212.4	270.8	1.19
27		629-59-4	Tetradecane	198.4	253.7	0.96
28		629-50-5	Tridecane	184.4	235.6	0.63
29		1120-21-4	Undecane	156.3	196.1	0.64
30	Alkaloids	1121-55-7	3-Ethenylpyridine *	105.1	82.0	1.11
31		54-11-5	Nicotine	162.3	247.0	5.65
32	Aromatic hydrocarbons	526-73-8	1,2,3-Trimethylbenzene	120.2	176.3	0.72
33		95-93-2	1,2,4,5-Tetramethylbenzene	134.2	197.0	0.81
34		95-63-6	1,2,4-Trimethylbenzene	120.2	169.5	0.79
35		95-47-6	1,2-Dimethylbenzene	106.2	144.6	0.64
36		108-38-3	1,3(4)-Dimethylbenzene	106.2	139.3	1.38
37		108-67-8	1,3,5-Trimethylbenzene	120.2	164.9	0.77

Table 4 (continued)

#	Class	CAS#	Compound	MW	BP (°C)	MDL (ng)
38	Aromatic hydrocarbons	611-14-3	2-Ethyltoluene	120.2	165.3	0.67
39		620-14-4	3-Ethyltoluene	120.2	161.5	0.65
40		622-96-8	4-Ethyltoluene	120.2	162.2	0.92
41		71-43-2	Benzene	78.1	80.2	3.76
42		100-41-4	Ethylbenzene	106.2	136.4	0.73
43		100-42-5	Styrene	104.2	145.3	0.79
44		108-88-3	Toluene	92.1	110.8	1.65
45	Esters	111-15-9	2-Ethoxyethyl acetate	132.2	156.5	5.26
46		123-86-4	Butyl-acetate	116.2	126.2	1.03
47		141-78-6	Ethyl-acetate	88.1	77.2	0.64
48		25265-77-4	Texanol (2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate)	216.3	244.0	3.52
49		6846-50-0	TXIB (2,2,4-Trimethyl-1,3-pentanediol diisobutyrate)	286.4	280.0	2.35
50	Glycol ethers	107-98-2	1-Methoxy-2-propanol	90.1	119.2	2.97
51		112-34-5	2-(2-Butoxyethoxy) ethanol	162.2	231.2	
52		111-76-2	2-Butoxyethanol	118.2	171.5	2.12
53		110-80-5	2-Ethoxyethanol	90.1	135.2	3.01
54		109-86-4	2-Methoxyethanol	76.1	124.6	3.14
55		5131-66-8	Propylene glycol monobutyl ether	132.2	171.0	2.69
56	Halo carbons	71-55-6	1,1,1-Trichloroethane	133.4	74.0	1.01
57		95-50-1	1,2-Dichlorobenzene	147.0	180.6	3.47
58		107-06-2	1,2-Dichloroethane	99.0	83.5	0.71
59		78-87-5	1,2-Dichloropropane	113.0	95.0	0.89
60		106-46-7	1,4-Dichlorobenzene	147.0	174.2	0.96
61		75-27-4	Bromodichloromethane	163.8	90.0	0.85
62		56-23-5	Carbon tetrachloride	153.8	76.7	0.61
63		67-66-3	Chloroform	119.4	61.2	0.55
64		124-48-1	Dibromochloromethane	208.3	119.0	0.70
65		75-09-2	Dichloromethane	84.9	39.9	0.75
66		79-34-5	1,1,2,2-Tetrachloroethane	167.8	146.5	
67		127-18-4	Tetrachloroethylene	165.8	121.1	0.66
68		79-01-6	Trichloroethylene	131.4	87.1	1.19
69	Terpenes	80-56-8	α-Pinene	136.2	156.3	0.65
70		127-91-3	β-Pinene	136.2	166.2	0.70
71		79-92-5	Camphene	136.2	160.7	2.08
72		138-86-3	Limonene	136.2	176.7	0.65

* 3-Ethenylpyridine is calibrated against 4-Ethenylpyridine (100-43-6)

** MW: molecular weight, BP: boiling point, MDL: method detection limit

3 Results and discussion

Emission factors for individual compounds are summarized in Table A. 1 to Table A. 9. The same information is visually presented in Figure A. 1 to Figure A. 177 in the appendix. These tables and figures were further condensed in this section for better comparison of the substance properties. For the presentation using tables and figures, the materials were grouped into two (building materials vs. consumer products) or three (solid building materials/furnishings/foam materials vs. liquid building materials vs. solid/liquid consumer products other than foam materials). The latter grouping is based on the test mode and the unit of the emission factor.

- The solid building materials/furnishings/foam materials (Group 1) were tested in the cell mode and the resulting emission factors had a unit of mass per unit area per hour ($\mu\text{g}/\text{m}^2/\text{h}$).
- The liquid building materials (Group 2) were tested in the cell mode on a glass disc and the resulting emission factors were expressed as mass of a compound per unit mass of a specimen per hour ($\mu\text{g}/\text{g}/\text{h}$).
- The consumer products (Group 3) were tested in either the cell or bulk mode with the resulting emission factor expressed in $\mu\text{g}/\text{g}/\text{h}$.

3.1 Overview on 72 compounds

The detection frequency of each compound is given in Table 5 for the three groups of materials. Alkaloids and halogenated compounds were rarely detected. Exceptions were 1,4-dichlorobenzene (detected in 36 specimens), 1,2-dichlorobenzene (12 specimens), dichloromethane (6 specimens) and carbon tetrachloride (1 specimen). Glycol ethers were the group of compounds with a detection frequency less than 10 %. Most compounds in the esters group had a detection frequency less than 20 %, while those in the alcohols, aldehydes and ketones were detected with a frequency above 20 % on average. Aliphatic hydrocarbons (HCs) showed a detection frequency above 30 %. Aromatic HCs and terpenes were most frequently detected with a detection frequency of more than 40 %.

Individual compounds with a detection frequency more than 50 % included:

- Phenol (alcohols)
- Acetone and 2-butanone (aldehydes & ketones)
- Decane, dodecane, nonane and undecane (aliphatic hydrocarbons)
- 1,2-Dimethylbenzene, 1,3(4)-dimethylbenzene, 1,2,3-trimethylbenzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,2,4,5-tetramethylbenzene, 2-ethyltoluene, 3-ethyltoluene, 4-ethyltoluene, benzene, ethylbenzene, styrene (aromatic HCs)
- α -Pinene and limonene (terpenes)

Table 5: Detection frequency of 72 compounds

#	Class	Compound	Detection Frequency (#)			Detection Frequency (%)		
			All ¹	Building materials (BM) ²	Consumer products (CP) ³	All ¹	Building materials (BM) ²	Consumer products (CP) ³
1	Alcohols	1-Butanol	29	21	8	28	34	18
2		1-Propanol	3	2	1	3	3	2
3		2-Ethyl-1-hexanol	24	16	8	23	26	18
4		2-Propanol	19	10	9	18	16	20
5		Ethanol	49	25	24	47	41	55
6		Phenol	55	31	24	52	51	55
7	Aldehydes & ketones	2-Butanone	55	35	20	52	57	45
8		4-Methyl-2-pentanone	6	4	2	6	7	5
9		Acetone	101	59	42	96	97	95
10		Benzaldehyde	30	15	15	29	25	34
11		Butanal	11	10	1	10	16	2
12		Decanal	5	0	5	5	0	11
13		Heptanal	9	4	5	9	7	11
14		Hexanal	15	6	9	14	10	20
15		Nonanal	18	8	10	17	13	23
16		Pentanal	11	8	3	10	13	7
17	Aromatic hydrocarbons	2,2,4-Trimethylpentane	4	2	2	4	3	5
18		2,4-Dimethylpentane	5	2	3	5	3	7
19		Decane	72	53	19	69	87	43
20		Dodecane	61	43	18	58	70	41
21		Heptane	13	7	6	12	11	14
22		Hexadecane	11	4	7	10	7	16
23		Hexane	0	0	0	0	0	0
24		Nonane	55	31	24	52	51	55
25		Octane	41	21	20	39	34	45
26		Pentadecane	29	10	19	28	16	43
27		Tetradecane	43	24	19	41	39	43
28		Tridecane	38	28	10	36	46	23
29		Undecane	69	46	23	66	75	52
30	Aldo/ks Alkaloids	3-Ethenylpyridine	1	0	1	1	0	2
31		Nicotine	0	0	0	0	0	0
32	Aromatic HCs	1,2,3-Trimethylbenzene	60	43	17	57	70	39
33		1,2,4,5-Tetramethylbenzene	51	35	16	49	57	36
34		1,2,4-Trimethylbenzene	61	44	17	58	72	39
35		1,2-Dimethylbenzene	79	51	28	75	84	64
36		1,3(4)-Dimethylbenzene	91	54	37	87	89	84
37		1,3,5-Trimethylbenzene	64	47	17	61	77	39

Table 5 (continued)

#	Class	Compound	Detection Frequency (#)			Detection Frequency (%)		
			All ¹	Building materials (BM) ²	Consumer products (CP) ³	All ¹	Building materials (BM) ²	Consumer products (CP) ³
38	Aromatic HCs	2-Ethyltoluene	70	52	18	67	85	41
39		3-Ethyltoluene	73	51	22	70	84	50
40		4-Ethyltoluene	70	49	21	67	80	48
41		Benzene	68	32	36	65	52	82
42		Ethylbenzene	91	55	36	87	90	82
43		Styrene	56	32	24	53	52	55
44		Toluene	50	34	16	48	56	36
45	Esters	2-Ethoxyethyl acetate	1	1	0	1	2	0
46		Butyl acetate	17	14	3	16	23	7
47		Ethyl acetate	22	11	11	21	18	25
48		Texanol	15	12	3	14	20	7
49		TXIB	26	21	5	25	34	11
50	Glycol ethers	1-Methoxy-2-propanol	5	2	3	5	3	7
51		2-(2-Butoxyethoxy) ethanol	6	6	0	6	10	0
52		2-Butoxyethanol	7	4	3	7	7	7
53		2-Ethoxyethanol	1	1	0	1	2	0
54		2-Methoxyethanol	1	1	0	1	2	0
55		Propylene glycol monobutyl ether	0	0	0	0	0	0
56	Halo carbons	1,1,1-Trichloroethane	0	0	0	0	0	0
57		1,2-Dichlorobenzene	12	2	10	11	3	23
58		1,2-Dichloroethane	0	0	0	0	0	0
59		1,2-Dichloropropane	0	0	0	0	0	0
60		1,4-Dichlorobenzene	36	16	20	34	26	45
61		Bromodichloromethane	0	0	0	0	0	0
62		Carbon tetrachloride	1	1	0	1	2	0
63		Chloroform	0	0	0	0	0	0
64		Dibromochloromethane	0	0	0	0	0	0
65		Dichloromethane	6	6	0	6	10	0
66		1,1,2,2-Tetrachloroethane	0	0	0	0	0	0
67		Tetrachloroethylene	0	0	0	0	0	0
68		Trichloroethylene	0	0	0	0	0	0
69	Terpenes	α -Pinene	57	22	35	54	36	80
70		β -Pinene	45	16	29	43	26	66
71		Camphepane	29	4	25	28	7	57
72		Limonene	54	19	35	51	31	80

¹ All tests (105 specimens), ² Solid/liquid building materials and furnishings (61 specimens: Test # 1 - 61 in Table A. 2 - Table A. 6), ³ Consumer products including foam materials (44 specimens: Test # 62 – 105 in Table A. 7 - Table A. 9), “Priority chemicals” are highlighted in blue.

Table 6: Summary statistics of emission factors

#	Class	Compound	Emission factor for solid bldg materials ($\mu\text{g}/\text{m}^2/\text{h}$) ¹				Emission factor for liquid bldg materials ($\mu\text{g}/\text{g}/\text{h}$) ²				Emission factor for consumer products ($\mu\text{g}/\text{g}/\text{h}$) ³			
			Min	Max	Mean	Median	Min	Max	Mean	Median	Min	Max	Mean	Median
1	Alcohols	1-Butanol	8.3	1784.8	479.8	63.1	0.0	43.0	6.8	1.2	0.1	116.5	25.0	3.0
2		1-Propanol	-	-	-	-	0.3	4.7	2.5	2.5	0.1	0.1	0.1	0.1
3		2-Ethyl-1-hexanol	6.7	1264.0	229.0	13.2	0.1	29.3	6.3	0.7	0.0	0.5	0.2	0.2
4		2-Propanol	11.2	62309.7	10405.0	29.5	6.9	60.6	28.1	22.4	0.7	750.3	158.2	4.0
5		Ethanol	0.5	10183.2	836.3	3.5	0.0	1288.4	111.1	1.4	0.0	6871.2	482.2	6.6
6		Phenol	5.6	267.3	38.3	12.4	0.0	66.3	6.2	0.0	0.0	0.1	0.0	0.0
7	Aldehydes & ketones	2-Butanone	4.5	485.1	48.8	10.8	0.0	2152.2	105.2	0.7	0.0	8.5	0.6	0.0
8		4-Methyl-2-pentanone	8.9	8.9	8.9	8.9	0.2	0.3	0.2	0.3	0.1	0.6	0.3	0.3
9		Acetone	3.6	330.9	75.8	18.2	0.0	1318.3	39.5	0.3	0.0	36.9	3.3	0.3
10		Benzaldehyde	5.5	18.3	13.2	15.7	0.0	9.8	3.5	1.3	0.1	347.3	38.2	1.2
11		Butanal	9.5	48.1	28.8	28.8	0.0	17.0	2.8	0.5	2.7	2.7	2.7	2.7
12		Decanal	-	-	-	-	-	-	-	-	0.1	16.7	6.6	1.0
13		Heptanal	17.4	44.4	30.7	30.4	0.1	0.1	0.1	0.1	0.0	0.4	0.2	0.1
14		Hexanal	3.9	1288.1	353.0	62.4	0.2	0.2	0.2	0.2	0.0	0.3	0.1	0.1
15		Nonanal	5.1	22.8	11.3	8.4	0.2	0.7	0.3	0.2	0.0	0.9	0.2	0.1
16		Pentanal	9.9	206.1	83.2	58.5	0.1	1.0	0.4	0.2	0.0	0.9	0.3	0.1
17	Aliphatic hydrocarbons	2,2,4-Trimethylpentane	-	-	-	-	0.4	0.5	0.4	0.4	0.1	4.7	2.4	2.4
18		2,4-Dimethylpentane	-	-	-	-	0.5	2.8	1.7	1.7	1.6	10.7	5.7	4.9
19		Decane	1.5	18586.3	825.1	5.8	0.0	1235.3	193.8	0.4	0.0	6.3	0.9	0.0
20		Dodecane	2.3	514.8	52.2	11.1	0.0	919.7	80.4	6.9	0.0	10.8	0.8	0.0
21		Heptane	10.2	161.8	70.6	39.7	0.1	305.1	76.4	0.2	0.2	294.4	69.7	12.6
22		Hexadecane	4.4	2028.4	511.5	6.6	0.7	0.7	0.7	0.7	0.0	0.7	0.1	0.0
23		Hexane	-	-	-	-	-	-	-	-	-	-	-	-
24		Nonane	1.6	13951.7	1277.4	7.0	0.0	1166.1	181.9	64.7	0.0	310.1	15.1	0.0
25		Octane	4.7	2185.9	446.7	14.4	0.0	118.7	19.5	2.6	0.0	542.0	29.8	0.0
26		Pentadecane	2.8	3483.2	356.3	6.9	0.0	0.3	0.1	0.1	0.0	10.0	0.8	0.0
27		Tetradecane	3.3	37.1	10.9	6.8	0.0	0.9	0.2	0.1	0.0	67.9	5.0	0.0
28		Tridecane	3.7	20.4	8.7	7.3	0.0	6.3	1.6	0.3	0.0	2.0	0.3	0.0
29		Undecane	2.3	7706.5	352.7	10.9	0.0	2265.0	209.9	29.9	0.0	33.3	2.1	0.1
30	Alkaloids	3-Ethenylpyridine	-	-	-	-	-	-	-	-	0.2	0.2	0.2	0.2
31		Nicotine	-	-	-	-	-	-	-	-	-	-	-	-
32	Aromatic HCs	1,2,3-Trimethylbenzene	0.9	3900.6	168.6	3.0	0.0	36.2	6.3	2.4	0.0	4.4	0.9	0.3
33		1,2,4,5-Tetramethylbenzene	0.4	348.1	36.1	3.0	0.0	21.1	3.0	1.0	0.0	0.0	0.0	0.0
34		1,2,4-Trimethylbenzene	0.3	8854.0	314.5	3.8	0.0	64.3	14.3	1.6	0.0	17.3	4.2	0.5
35		1,2-Dimethylbenzene	1.4	1622.5	97.1	4.2	0.0	97.1	10.4	0.8	0.0	183.8	11.4	0.1
36		1,3(4)-Dimethylbenzene	2.1	4868.1	290.1	7.2	0.0	244.0	22.6	1.4	0.0	122.1	8.2	0.0
37		1,3,5-Trimethylbenzene	0.5	2560.4	102.9	1.9	0.0	37.7	5.2	1.1	0.0	9.1	2.0	0.3

Table 6 (continued)

#	Class	Compound	Emission factor for solid bldg materials ($\mu\text{g}/\text{m}^2/\text{h}$) ¹				Emission factor for liquid bldg materials ($\mu\text{g}/\text{g}/\text{h}$) ²				Emission factor for consumer products ($\mu\text{g}/\text{g}/\text{h}$) ³			
			Min	Max	Mean	Median	Min	Max	Mean	Median	Min	Max	Mean	Median
38	Aromatic HCs	2-Ethyltoluene	0.3	1946.3	75.6	1.4	0.0	12.4	1.9	0.3	0.0	3.1	0.7	0.1
39		3-Ethyltoluene	0.8	4508.1	172.2	2.4	0.0	32.4	4.7	0.8	0.0	10.7	2.3	0.2
40		4-Ethyltoluene	0.4	1988.2	82.4	1.5	0.0	15.1	2.2	0.4	0.0	6.2	1.1	0.1
41		Benzene	0.6	367.7	49.5	7.9	0.0	5.7	0.3	0.0	0.0	4.0	0.2	0.0
42		Ethylbenzene	0.6	1029.0	76.8	2.8	0.0	131.3	8.9	0.3	0.0	18.4	1.7	0.0
43		Styrene	0.8	900.6	47.9	3.9	0.0	39.5	8.3	0.3	0.0	14.3	1.1	0.0
44		Toluene	2.3	1540.1	87.2	10.2	0.0	354.7	25.7	0.2	0.0	102.3	18.5	1.5
45	Esters	2-Ethoxyethyl acetate	23.1	23.1	23.1	23.1	-	-	-	-	-	-	-	-
46		Butyl acetate	7.8	526.6	139.8	12.6	0.0	1.1	0.4	0.1	0.0	0.7	0.3	0.1
47		Ethyl acetate	67.7	879.6	348.1	97.0	0.0	3.0	1.2	0.9	0.0	5.8	1.1	0.1
48		Texanol	9.2	132.9	71.1	71.1	0.1	126.9	31.2	1.4	0.0	73.6	36.8	36.8
49		TXIB	2.7	10014	1135	19.9	0.0	77.6	7.3	0.1	0.1	0.2	0.2	0.2
50	Glycol ethers	1-Methoxy-2-propanol	-	-	-	-	0.5	21.3	10.9	10.9	3.6	7.1	5.5	5.8
51		2-(2-Butoxyethoxy) ethanol	535.1	535.1	535.1	535.1	0.7	160.3	47.7	21.6	-	-	-	-
52		2-Butoxyethanol	19.7	26.0	22.9	22.9	0.2	800.7	267.5	1.7	1.9	526.4	264.2	264.2
53		2-Ethoxyethanol	-	-	-	-	0.3	0.3	0.3	0.3	-	-	-	-
54		2-Methoxyethanol	-	-	-	-	2.0	2.0	2.0	2.0	-	-	-	-
55		Propylene glycol monobutyl ether	-	-	-	-	-	-	-	-	-	-	-	-
56	Halo carbons	1,1,1-Trichloroethane	-	-	-	-	-	-	-	-	-	-	-	-
57		1,2-Dichlorobenzene	1.8	12.1	8.3	11.2	0.01	0.01	0.01	0.01	0.0	8.1	1.2	0.0
58		1,2-Dichloroethane	-	-	-	-	-	-	-	-	-	-	-	-
59		1,2-Dichloropropane	-	-	-	-	-	-	-	-	-	-	-	-
60		1,4-Dichlorobenzene	1.3	2593.1	396.6	53.2	0.0	277.3	92.5	0.3	0.1	148.5	19.3	0.2
61		Bromodichloromethane	-	-	-	-	-	-	-	-	-	-	-	-
62		Carbon tetrachloride	-	-	-	-	0.1	0.1	0.1	0.1	-	-	-	-
63		Chloroform	-	-	-	-	-	-	-	-	-	-	-	-
64		Dibromochloromethane	-	-	-	-	-	-	-	-	-	-	-	-
65		Dichloromethane	15.3	58.4	27.5	16.7	-	-	-	-	-	-	-	-
66		1,1,2,2-Tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-
67		Tetrachloroethylene	-	-	-	-	-	-	-	-	-	-	-	-
68		Trichloroethylene	-	-	-	-	-	-	-	-	-	-	-	-
69	Terpenes	α -Pinene	2.1	258.5	42.7	15.1	0.0	0.2	0.1	0.1	0.0	1588.1	85.8	0.4
70		β -Pinene	1.9	30.0	9.4	5.0	0.0	0.1	0.1	0.0	0.0	332.4	29.3	0.2
71		Camphene	4.3	8.8	5.6	4.6	-	-	-	-	0.0	194.6	8.1	0.1
72		Limonene	4.8	66.6	16.0	11.3	0.0	7.0	2.0	0.3	0.0	898.3	71.3	1.1

¹ Solid building materials/furnishings/foam materials (30 specimens: Test # 1 – 24, 100 – 105), ² Liquid building materials (37 specimens: Test ID 25 – 61), ³ Liquid/solid consumer products (38 specimens: Test ID 62 – 99), “Priority chemicals” are highlighted in blue.

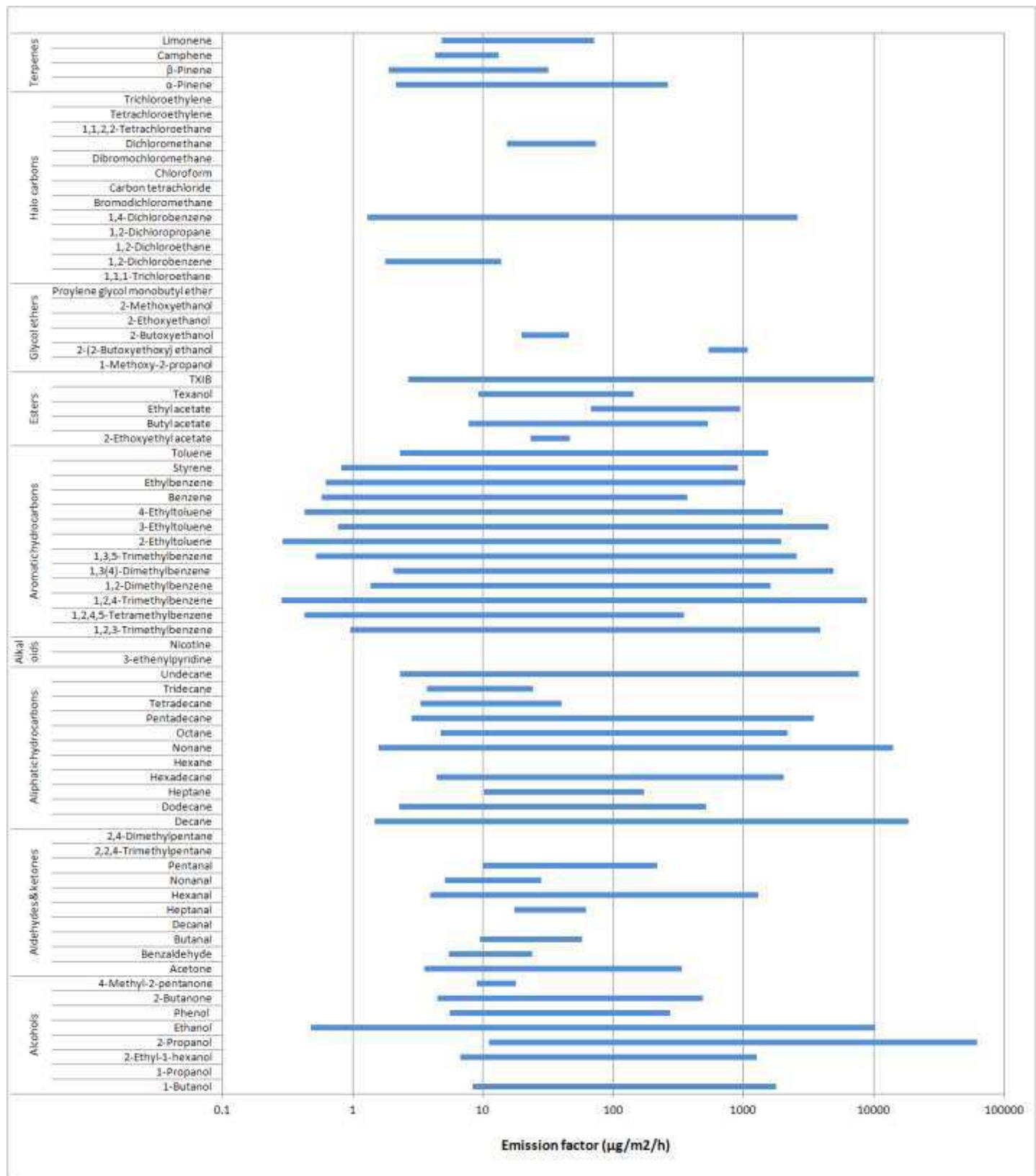


Figure 1: Range of emission factors for solid building materials/furnishings/foam materials (Group 1, $\mu\text{g}/\text{m}^2/\text{h}$)

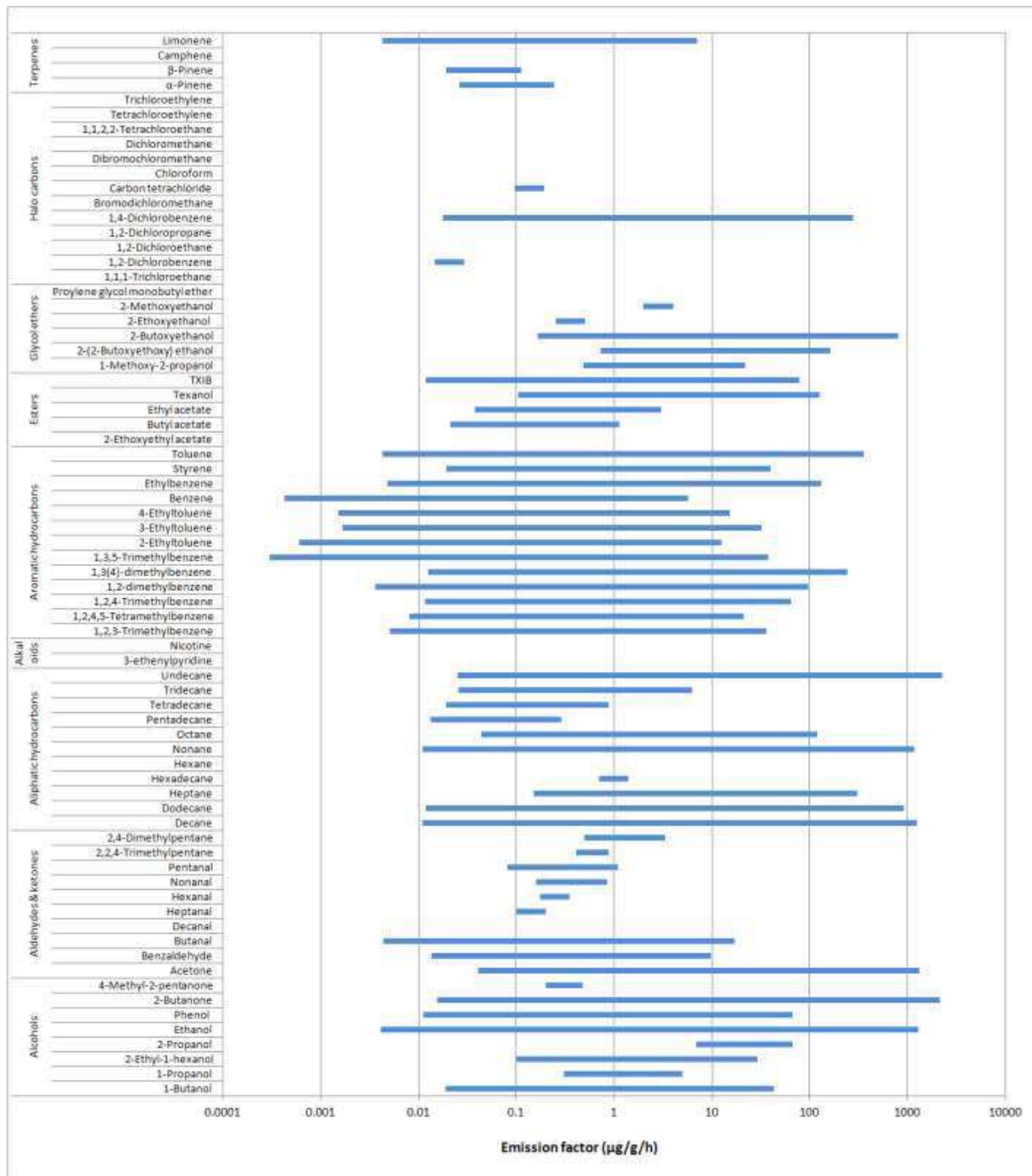


Figure 2: Range of emission factors for liquid building materials (Group 2, $\mu\text{g/g/h}$)

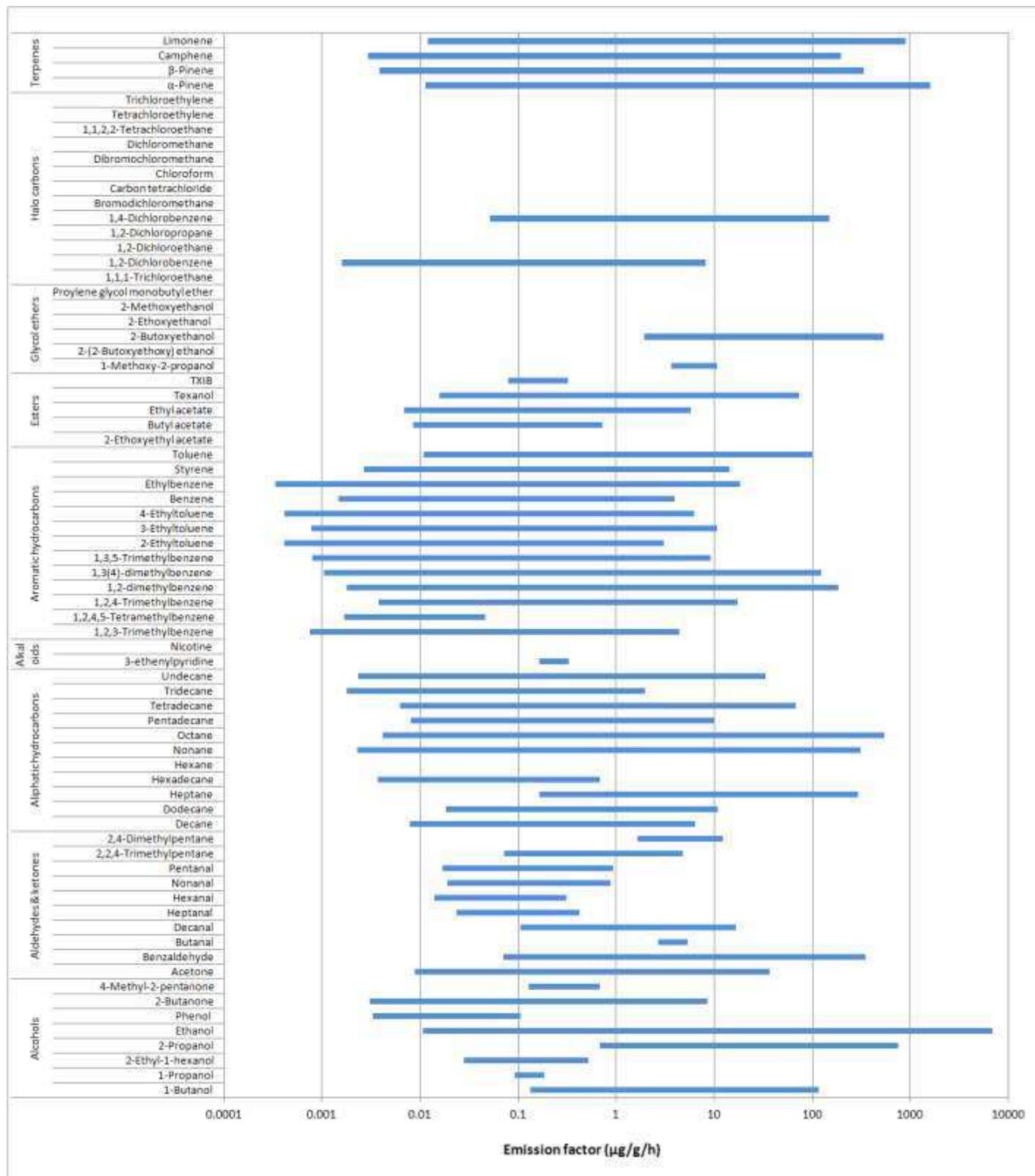


Figure 3: Range of emission factors for consumer products (Group 3, $\mu\text{g/g/h}$)

The compounds that were not detected in any of 105 specimens included:

- Hexane (aliphatic hydrocarbon)
- Nicotine (alkaloid)
- Proylene glycol monobutyl ether (glycol ether)
- 1,1,1-Trichloroethane, 1,2-dichloroethane, 1,2-dichloropropane, bromodichloromethane, chloroform, dibromochloromethane, 1,1,2,2-tetrachloroethane, tetrachloroethylene and trichloroethylene (halogenated compounds)

The compounds with a detection frequency less than 5 % included:

- 1-Propanol (alcohol)
- Decanal (aldehyde)
- 2,2,4-Trimethylpentane, 2,4-dimethylpentane (aliphatic hydrocarbons)
- 3-Ethenylpyridine (alkaloid)
- 2-Ethoxyethyl acetate (ester)
- 1-Methoxy-2-propanol, 2-ethoxyethanol, 2-methoxyethanol (glycol ethers)
- Carbon tetrachloride (halogenated compounds)

The detection frequency of most compounds showed similar patterns when materials were grouped into two categories of building materials and furnishings (Group 1 and 2) and consumer products (Group 3). One exception was that terpenes were more frequently detected in consumer products. It was most pronounced with camphene, which was detected only in consumer products (Table A. 7 to Table A. 9). An artistic oil varnish had the biggest emission factor, followed by an air freshener. The observation is not surprising since these consumer products are typically designed to emit fragrances whose formulations can contain terpenes.

Descriptive statistics of emission factors for each compound are summarized in Table 6, whose information is visually presented in Figure 1 for solid building materials/furnishings/foam materials (Group 1), in Figure 2 for liquid building materials (Group 2) and in Figure 3 for consumer products other than foam materials (Group 3). The median values tend to be smaller than the mean values, indicating that the emission factors have skewed distributions with the tail on the right side. A wide range of emissions factors was observed for each compound. The maximum difference between the minimum and maximum emission factors were 10^4 for solid building materials/furnishings/foam materials (Group 1), and 10^5 for other two groups of materials (Group 2 and 3). This indicates that the surface emitting materials (e.g., solid building materials and furnishings) tend to have smaller ranges of emission factors than that of the bulk emitting materials (e.g., liquid building materials and consumer products).

The same information is further condensed for different groups of compounds in Figure 4, which is based on the minimum and maximum emission factors averaged for each chemical group. It shows that the range of mean emission factors was smaller for Group 1 materials. Direct comparison of emission factors can be done only for Group 2 and 3 materials whose emission factors were expressed in the identical unit of $\mu\text{g/g/h}$. Liquid building materials (Group 2) tend to have higher maximum emission factors than consumer products (Group 3). Exceptions were terpenes and alcohols, which were emitted in a wider range and at higher maximum emission factors from consumer products.

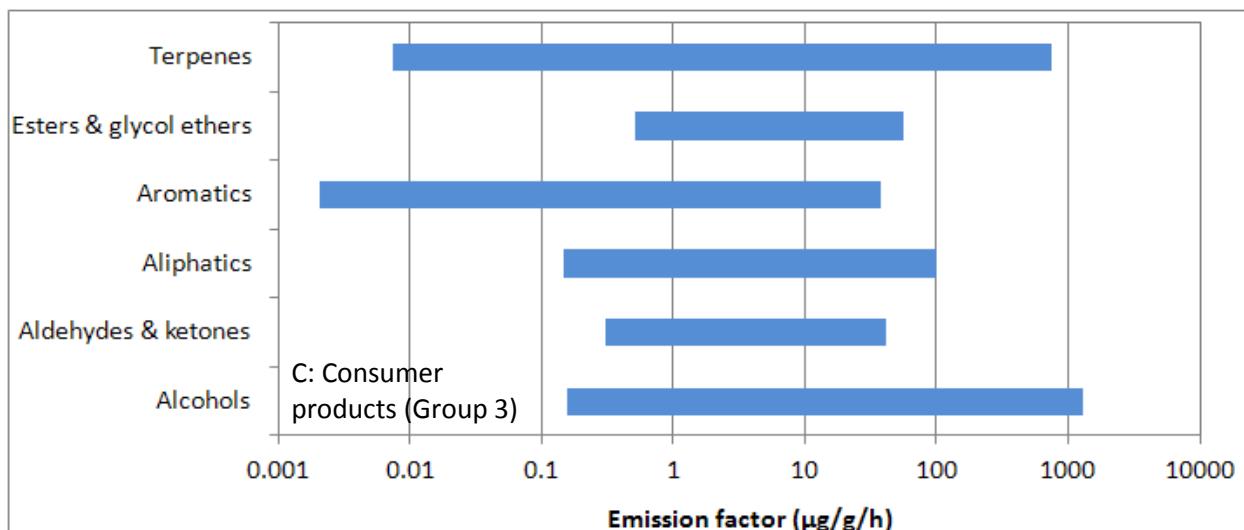
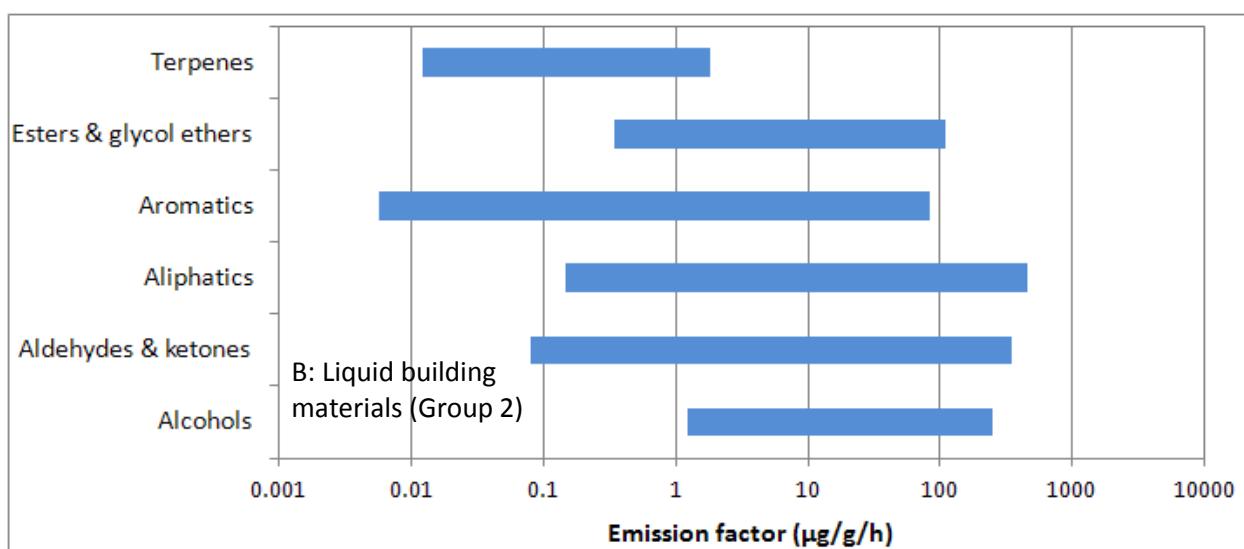
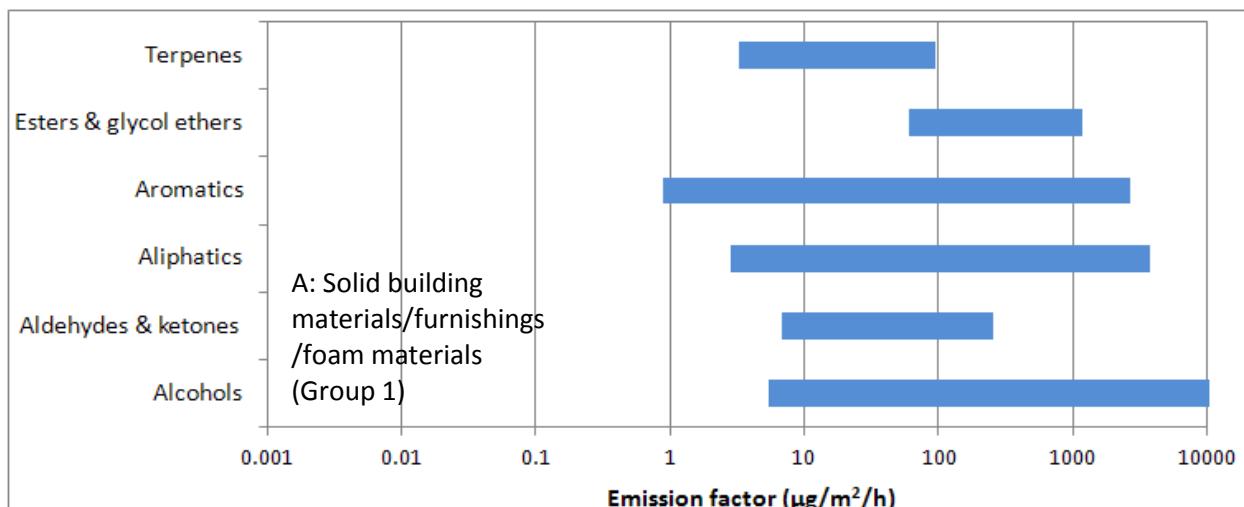


Figure 4: Range of emission factors grouped for different chemical groups

3.2 Comparison to past emission data

To check whether there has been any historical change in the type of compounds emitted, the data from this study conducted in 2010/11 were compared with the data from IA-QUEST, which contains the emission factors for 90 VOCs from 58 building materials tested in 50-L chambers in 1998 and 2004 (NRC-IRC, 2009). A direct comparison of emission factors is not possible for several reasons, one being that the screening test for the naphthalene project measured early emissions (e.g., 0.5 – 2 hours) and the 50-L chamber test for IA-QUEST was intended for emissions at quasi-steady state (e.g., > 24 hours). The comparison of detection frequencies is presented in Figure 5 for solid building materials and Figure 6 for liquid building materials for 59 VOCs common to both data sets. The detection frequencies, which were calculated from data sets including those below the detection limit for consistency between two studies, is summarized for different classes of compounds in Table 7. The detection frequencies of aldehydes, ketones, aliphatic hydrocarbons and halogenated compounds were reduced in data sets measured in 2010/11. The declined detection frequency was most visible with halogenated compounds for liquid building materials. No major changes were observed for aromatic hydrocarbons and terpenes, in particular, for liquid building materials. There was a general increasing detection frequency for alcohols, esters and glycol ethers. Although the comparison is limited by the fact that materials were similar but not identical in both studies, the observation may reflect the product formulation changes, possibly from aliphatic hydrocarbons and halogenated compounds to oxygenated compounds.

Table 7: Detection frequency (%) for chemical classes

Project	Solid building materials		Liquid building materials	
	IA-QUEST (1998 & 2004) ¹	Naphthalene Project (2010/11) ²	IA-QUEST (1998 & 2004) ¹	Naphthalene Project (2010/11) ²
Materials tested	41 materials - vinyl flooring, carpet, under-pad, solid wood, acoustical tile, gypsum board, OSB, plywood, laminated flooring, counter top	30 materials: vinyl flooring, carpet/mat, under-pad, furniture (wood, vinyl), foam materials	17 materials - adhesive, caulking, paint, primer, wood stain, urethane, wax	37 materials - adhesive, caulking, paint, primer, wood stain, wax
Alcohols	13	35	6	25
Aldehydes & ketones	51	26	35	24
Aliphatic HCs	61	35	52	36
Aromatic HCs	68	82	66	67
Esters	6	17	11	20
Glycol ethers	0	2	1	6
Halogenated cmpnds ³	30	23	29	3
Terpenes	51	49	6	9

¹ Indoor Air Quality Simulation Tool (IA-QUEST) from the material emissions project 1 and 2 (1998 & 2004); ²

Naphthalene project (2010); ³ Four compounds including 1,2-dichlorobenzene, 1,4-dichlorobenzene, dichloromethane and trichloroethylene.

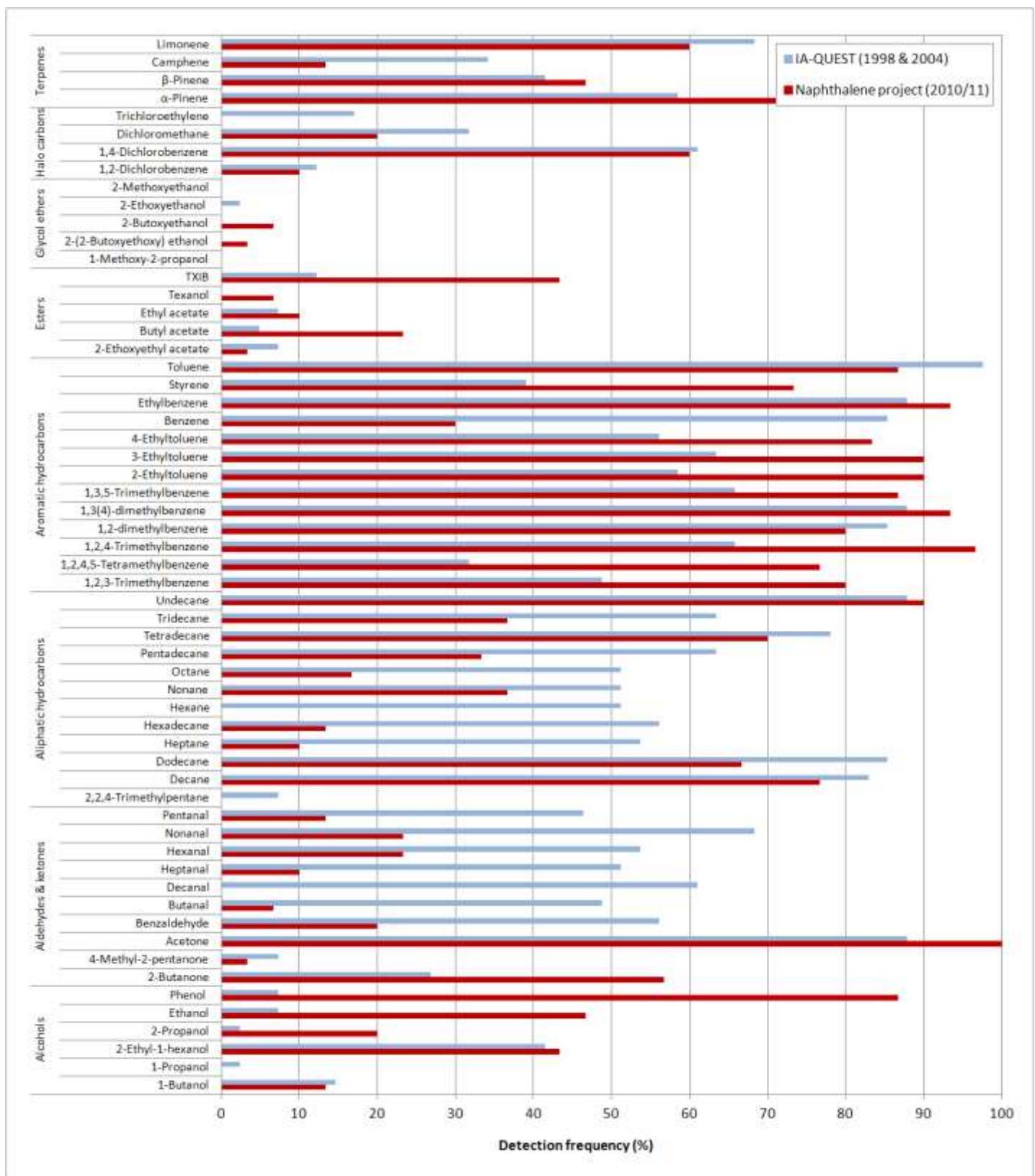


Figure 5: Comparison of detection frequency (%) for solid building materials/furnishings tested in 1998-2004 and 2010/11.

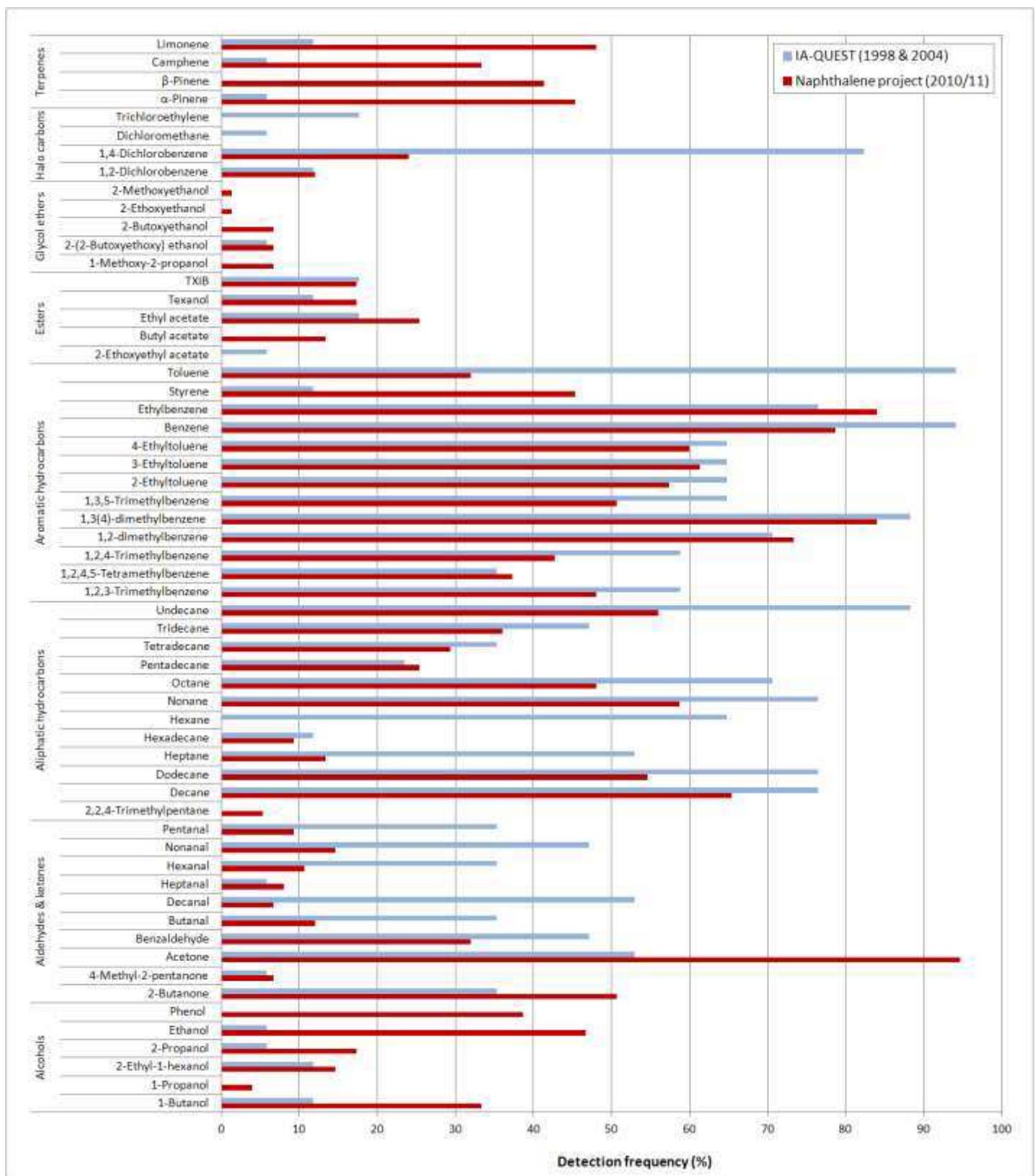


Figure 6: Comparison of detection frequency (%) for liquid building materials tested in 1998-2004 and 2010/11.

3.3 Correlations among compounds

Correlations among compounds were determined with Spearman Rank Order Correlation using data sets with a detection frequency greater than 50 %. Table 8 summarizes the correlation coefficients (R^2). The R^2 values greater than 0.7 are highlighted in light green and those with statistical significance ($\alpha = 0.05$) are presented in bold. The results show that compounds in the same chemical group tend to be highly correlated. For example, the correlation coefficients among aliphatic hydrocarbons (nonane, decane, undecane and dodecane) were greater than 0.76 and those among aromatic compounds were greater than 0.7 in ~50 % of the combinations. Limonene showed the highest correlation with α -pinene ($R^2 = 0.75$). Within the group of alcohols and ketones, the correlation coefficient between phenol and 2-butanol was the highest ($R^2 = 0.84$). It implies that the compounds in the same chemical group are likely to be emitted from same sources. The observation is not surprising, considering that a group of compounds have similar properties that can provide a desired functionality to commercial products.

Table 8: Correlation coefficients (R^2) among compounds with a detection frequency > 50 %

	Phenol	2-Butanone	cetone	Decane	Dodecane	Nonane	Undecane	1,2,3-TMB	1,2,4,5-TMB	1,2,4-TMB	1,2-DMB	1,3(4)-DMB	1,3,5-TMB	2-Ethyltoluene	3-Ethyltoluene	4-Ethyltoluene	Benzene	Ethylbenzene	Styrene	α -Pinene	Limonene
Ethanol	0.41	0.47	0.38	0.45	0.54	0.33	0.22	0.17	0.11	0.22	0.23	0.04	0.49	0.52	0.43	0.47	0.27	0.03	0.22	0.03	0.15
Phenol		0.84	0.74	0.78	0.78	0.65	0.80	0.56	0.72	0.43	0.59	0.61	0.46	0.67	0.59	0.63	0.87	0.63	0.68	0.63	0.45
2-Butanone			0.65	0.54	0.64	0.60	0.59	0.40	0.64	0.26	0.47	0.52	0.23	0.36	0.31	0.32	0.64	0.53	0.79	0.29	-0.05
Acetone				0.38	0.47	0.37	0.39	0.49	0.57	0.37	0.53	0.58	0.36	0.43	0.40	0.50	0.69	0.59	0.71	0.56	0.46
Decane					0.85	0.89	0.93	0.60	0.32	0.59	0.63	0.69	0.61	0.65	0.71	0.63	0.65	0.67	0.54	0.59	0.46
Dodecane						0.76	0.90	0.62	0.60	0.50	0.58	0.69	0.54	0.53	0.58	0.53	0.54	0.62	0.53	0.34	0.30
Nonane							0.76	0.47	0.26	0.41	0.69	0.77	0.45	0.63	0.67	0.63	0.68	0.72	0.72	0.38	0.13
Undecane								0.65	0.40	0.61	0.53	0.64	0.61	0.64	0.71	0.60	0.59	0.59	0.45	0.45	0.57
1,2,3-TMB ¹									0.74	0.95	0.62	0.69	0.95	0.89	0.83	0.81	0.62	0.60	0.45	0.36	0.29
1,2,4,5-TMB ²										0.60	0.47	0.55	0.56	0.58	0.41	0.49	0.61	0.49	0.39	0.27	0.24
1,2,4-TMB ¹											0.67	0.66	0.97	0.87	0.90	0.85	0.55	0.59	0.41	0.09	-0.13
1,2-DMB ³												0.98	0.63	0.66	0.72	0.71	0.71	0.97	0.81	0.36	0.25
1,3(4)-DMB ³													0.66	0.67	0.74	0.73	0.73	0.98	0.78	0.39	0.32
1,3,5-TMB ¹													0.90	0.88	0.89	0.51	0.60	0.43	0.23	0.16	
2-Ethyltoluene														0.92	0.95	0.53	0.63	0.54	0.24	0.28	
3-Ethyltoluene															0.97	0.58	0.69	0.63	0.26	0.21	
4-Ethyltoluene																0.58	0.69	0.67	0.31	0.33	
Benzene																	0.74	0.76	0.45	0.31	
Ethylbenzene																		0.82	0.37	0.27	
Styrene																			0.58	0.30	
α -Pinene																				0.75	

Note: ¹ TMB: trimethylbenzene, ² TMB: tetramethylbenzene, ³ DMB: dimethylbenzene

Values in bold with P < 0.05

3.4 Seventeen priority chemicals

Seventeen compounds identified as priority chemicals in the process of developing the indoor air quality guidelines for VOCs by Health Canada were analyzed in more detail in this section. Among the 17 compounds, no information was generated for the following compounds since they were not compatible with adsorbent sampling on Tenax TA or Carbotrap 300 and subsequent thermal desorption:

- acrolein
- acetaldehyde
- ethylene oxide
- propanal
- 1,3-butadiene
- propylene oxide

The remaining 11 compounds were grouped into three categories (alcohols, aromatics and chlorinated compounds).

3.4.1 Alcohols: 2-propanol

2-Propanol was detected in 19 % of materials (10 % from building materials/furnishings and 9 % from consumer products) as shown in Table 5. The emission factors of 2-propanol are compared with those of hexanal, which was highly correlated with 2-propanol ($R^2 = 0.89$ and P value = 0.03), in Figure 7 to Figure 9. The sources of 2-propanol were wooden furniture (FUR1 to 3 and 5 to 6), shampoo (SHP1 to 3), and cleaning products (CL1 to 3). A laminated floor/adhesive composite (ADH6LF) showed the highest emission factor among surface emitting materials (Group 1). Several liquid building materials emitted 2-propanol with an emission factor smaller than those from consumer products. The common sources of 2-propanol and hexanal were wooden furniture (FUR1 to 3 and 5), cleaning product (CL2) and incense stick (INS1).

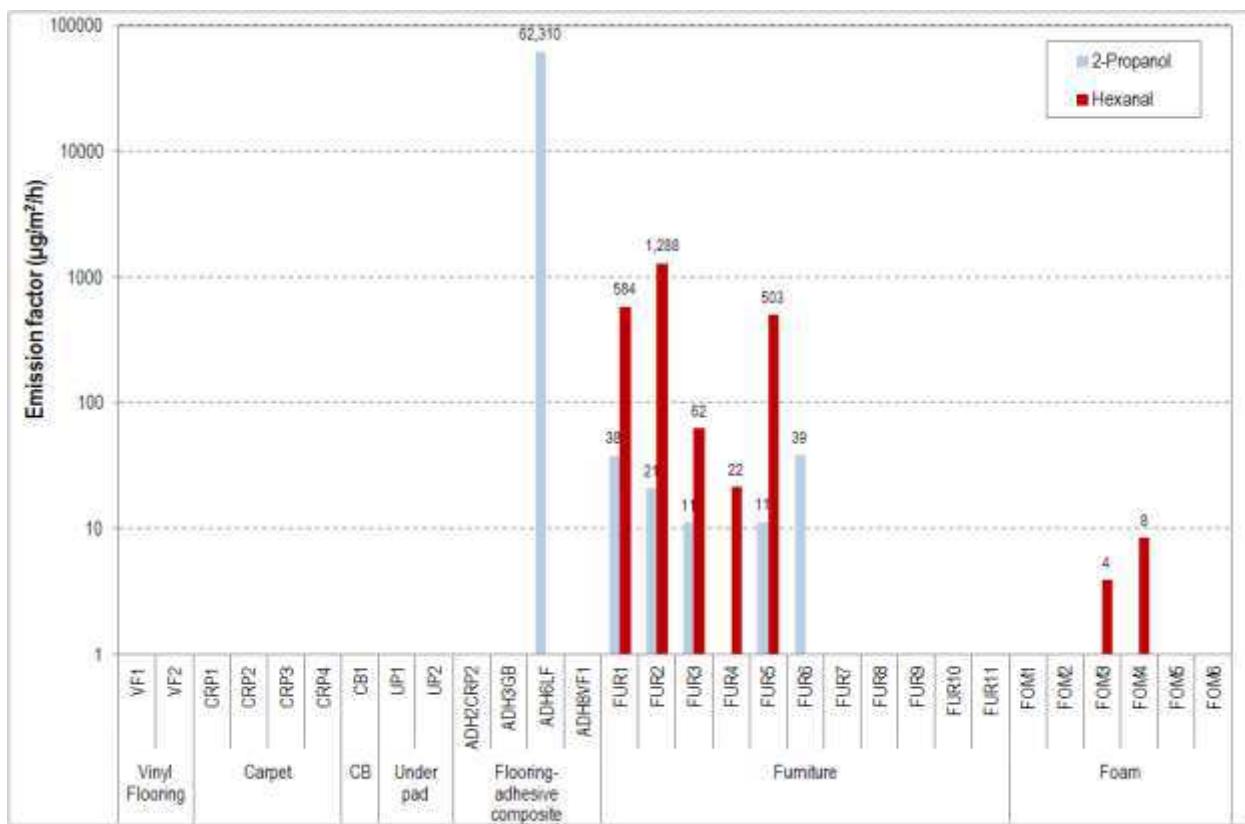


Figure 7: Emission factors for solid building materials/furnishings/foam products (2-propanol and hexanal)

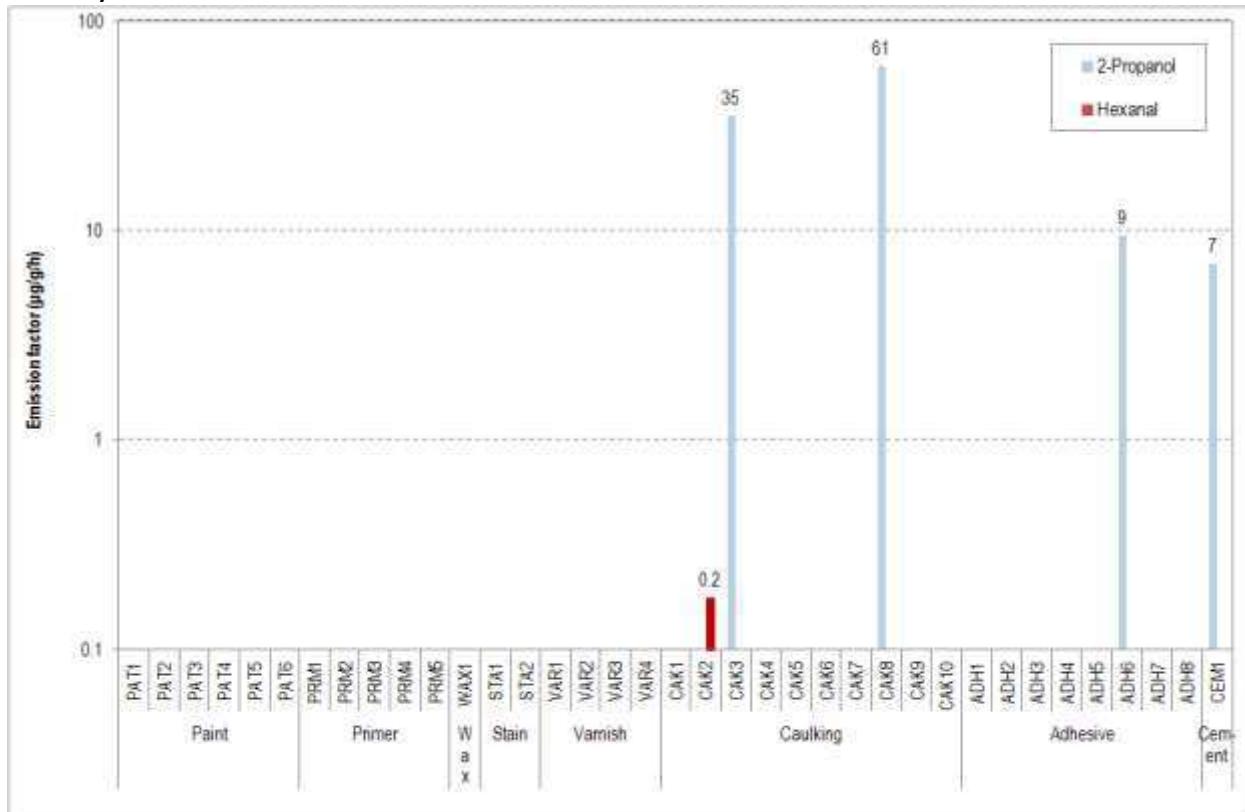


Figure 8: Emission factors for liquid building materials (2-propanol and hexanal)

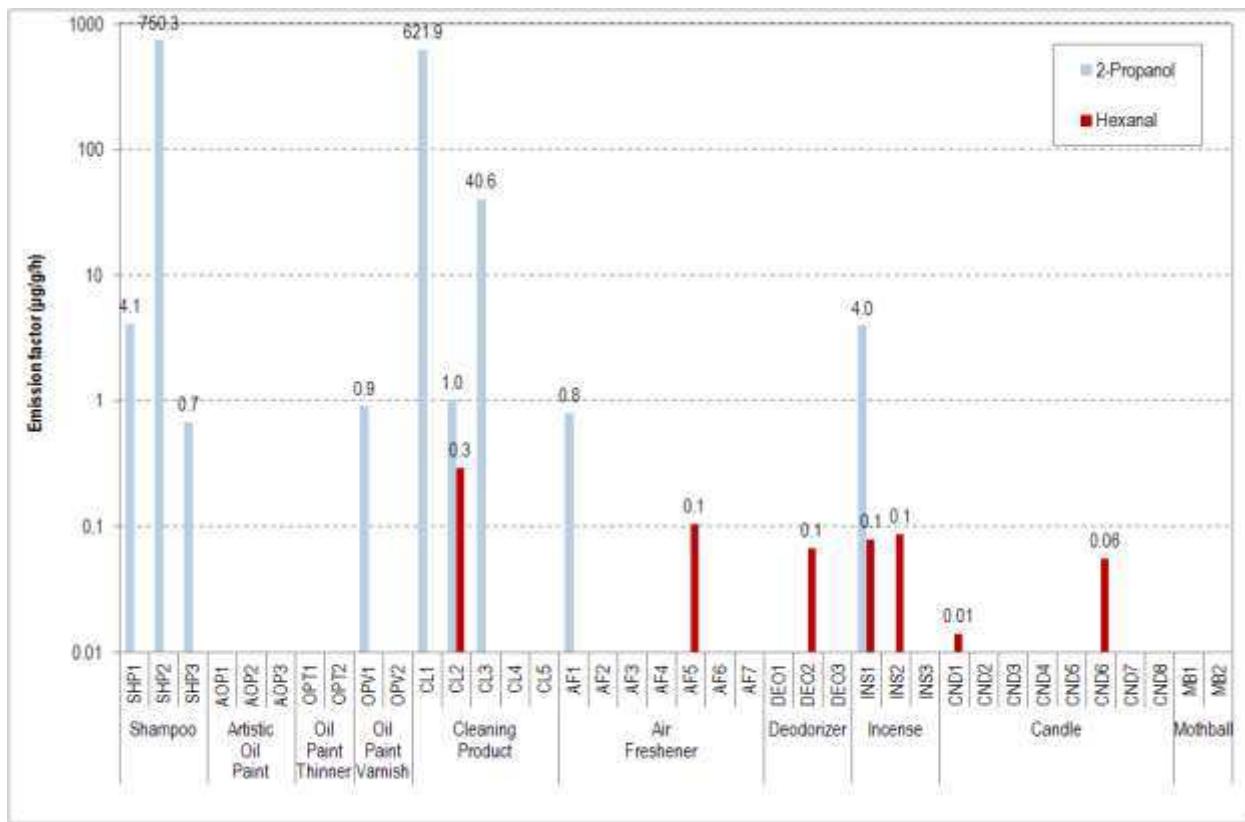


Figure 9: Emission factors for consumer products (2-propanol and hexanal)

3.4.2 Aromatic compounds: benzene, ethyl benzene and xylenes

These aromatic compounds belong to the group of compounds with the highest detection frequency (65 – 87 %) (Table 5). About 20 % of the detected levels of aromatic compounds were below the detection limit (MDL). Benzene was emitted in the level below MDL in majority of cases. That is, benzene (detection frequency of 65 %) was detected in 20 % cases with the level above MDL.

The emission factors of four aromatic compounds (benzene, ethylbenzene, 1,2-dimethylbenzene and 1,3-dimethylbenzene) are compared in Figure 10 to Figure 12. The high correlations among these four compounds shown in Table 8 can also be observed in these figures. A product tends to emit four compounds together with several exceptions. Among the materials tested in the surface emitting mode, flooring-adhesive composites and foam products tend to be higher emitters than other materials. The highest emission factors were observed with two caulking specimens (CAK7 and 8) among liquid building materials. It is not surprising since CAK7 was intended for exterior usage and petroleum based solvent was reported to be the ingredient of CAK8. The consumer products with higher emissions of these aromatics are various, including artistic paint thinner (OPT1), cleaning product (CL4), incense (INS3) and mothball (MB2). It was also reported by the manufacturers that petroleum based solvents were ingredients of OPT1 and CL4. It is surprising to see MB2 as a high emitter of aromatic compounds since the product's main ingredient was naphthalene. INS3 was the cheapest

among three incense sticks tested, which may explain why INS3 emitted higher level of aromatic compounds than others.

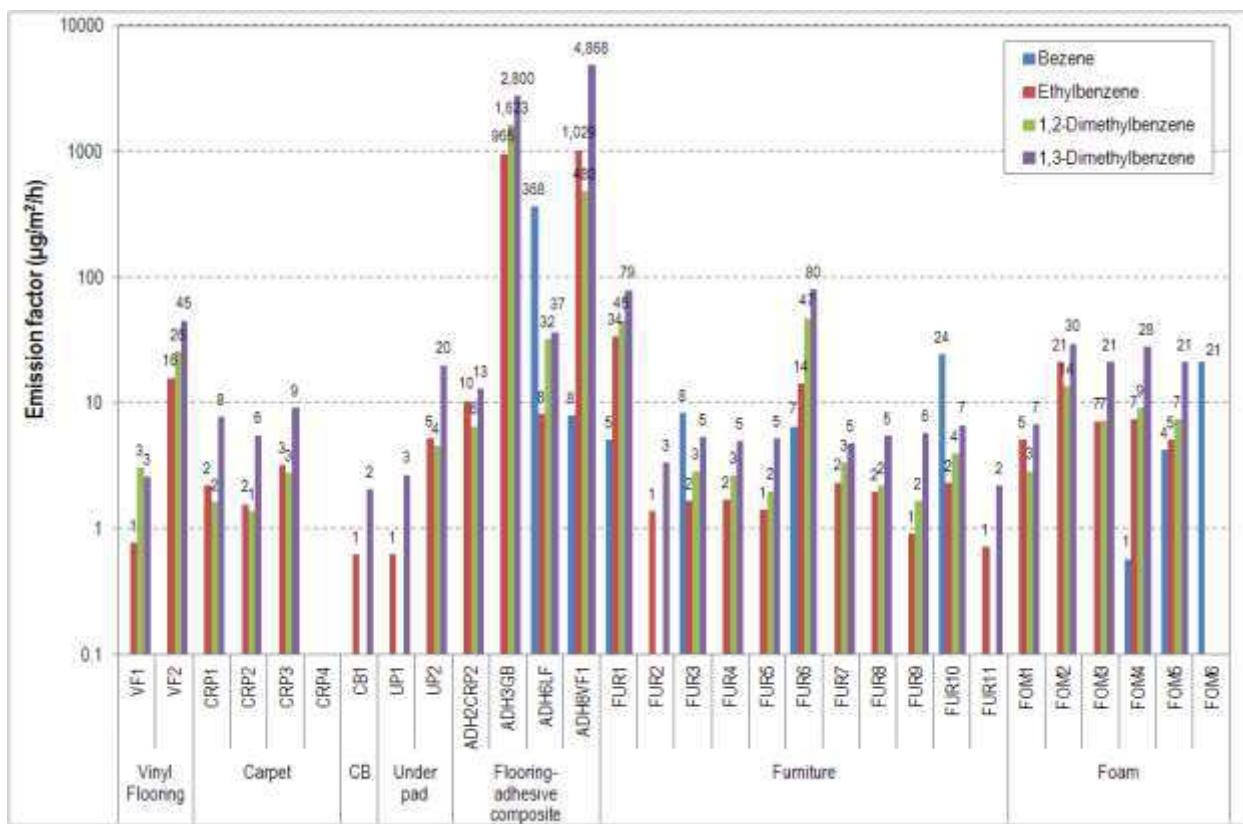


Figure 10: Emission factors for solid building materials/furnishings/foam products (4 aromatic compounds)

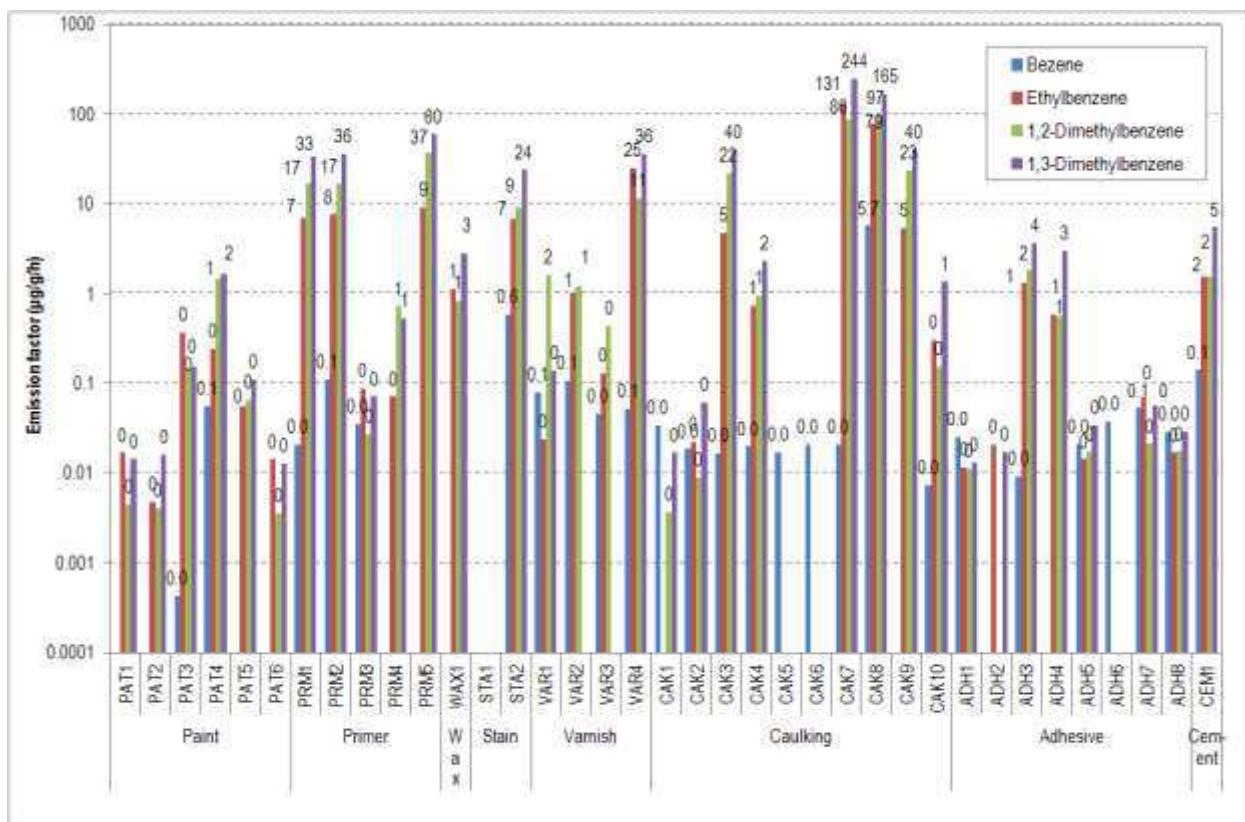


Figure 11: Emission factors for liquid building materials (4 aromatic compounds)

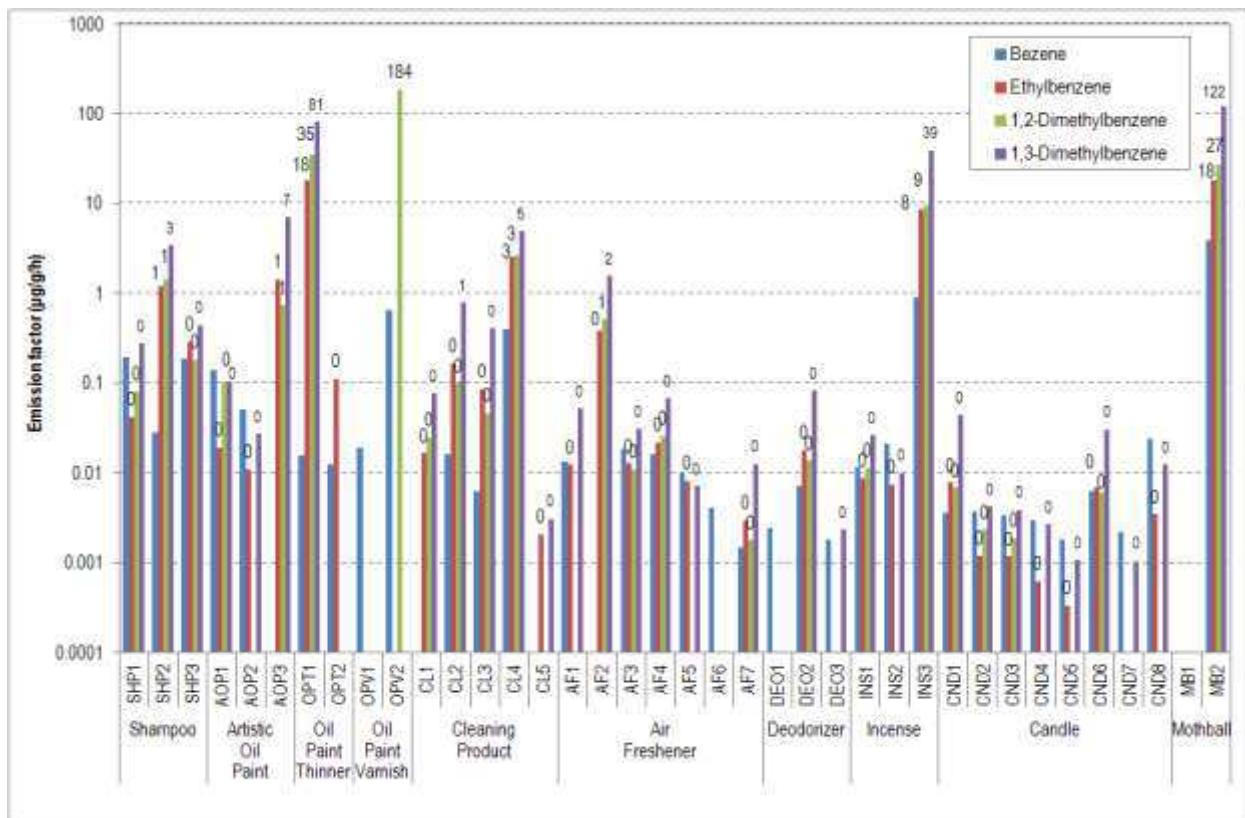


Figure 12: Emission factors for consumer products (4 aromatic compounds)

3.4.3 Chlorinated compounds

As mentioned previously, the detection frequency of chlorinated compounds was very low. 1,2-Dichloroethane, chloroform, 1,1,2,2-tetrachloroethane, and tetrachloroethylene were not detected in any materials tested. Carbon tetrachloride was emitted only from an adhesive product for engineered wood and laminated floor (ADH6). The emission factor was relatively low ($0.1 \mu\text{g/g/h}$).

1,4-Dichlorobenzene (34 %) and dichloromethane (6 %) were the compounds with a higher detection frequency. The emission factors of two compounds are compared in Figure 13 to Figure 15. Wooden furniture panels were the major emitters of dichloromethane (FUR1 to 6). 1,4-Dichlorobenzene was mainly emitted from furnishings and solid consumer products. The sources included wooden furniture (FUR1 to 3 and 5 to 6), vinyl furniture (FUR7 to 11), foam products (FOM2 to 6), deodorant blocks for closet and toilet (DEO1 & 3), incense (INS1 to 3), candle (CDN1 to 7) and mothball (MB1 & 2). Among building materials, one wood stain (STA2) showed a high emission of 1,4-dichlorobenzene. It is not clear why STA2 had a higher emission than STA1, considering that both products were oil-based. Compared to aromatic compounds, chlorinated compounds were emitted from less diverse product categories. While two under-pad specimens emitted 1,4-dichlorobenzene, the levels were below the detection limit.

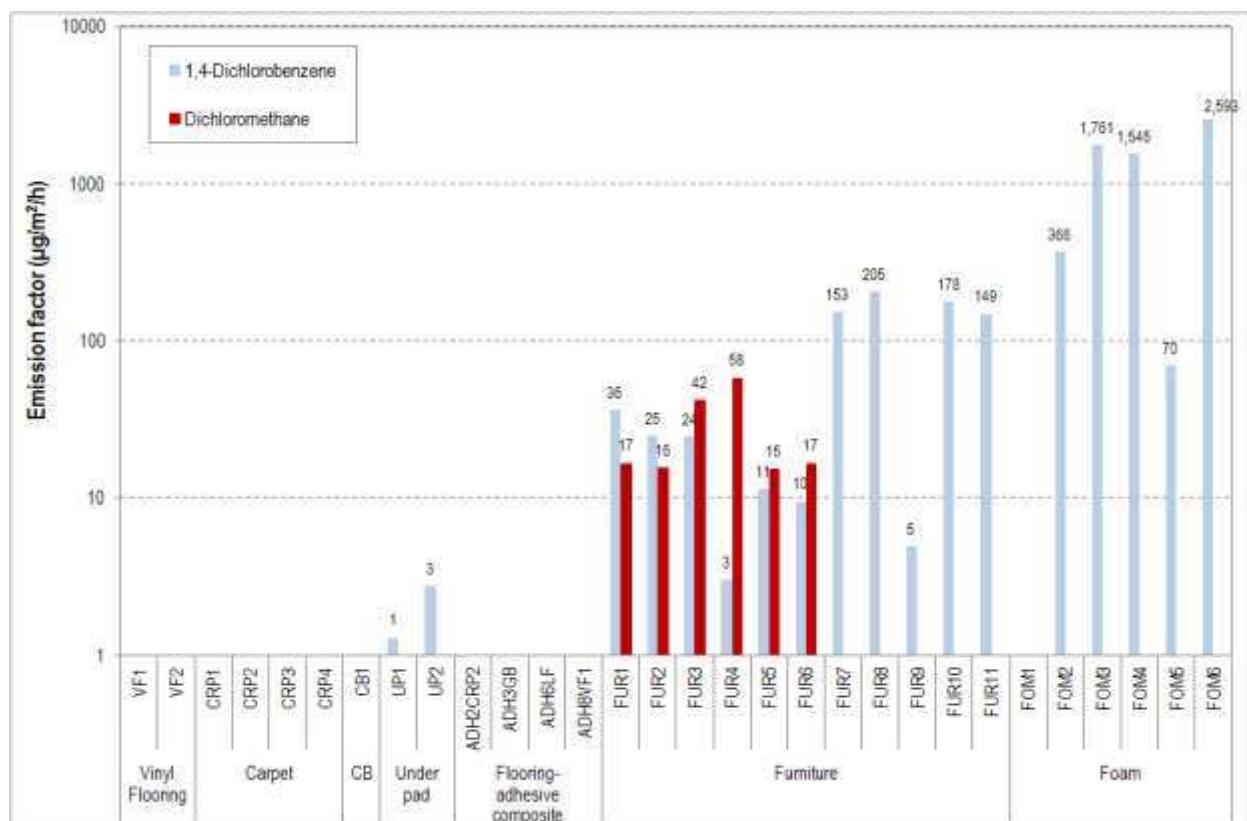


Figure 13: Emission factors for solid building materials/furnishings/foam products (2 chlorinated compounds)

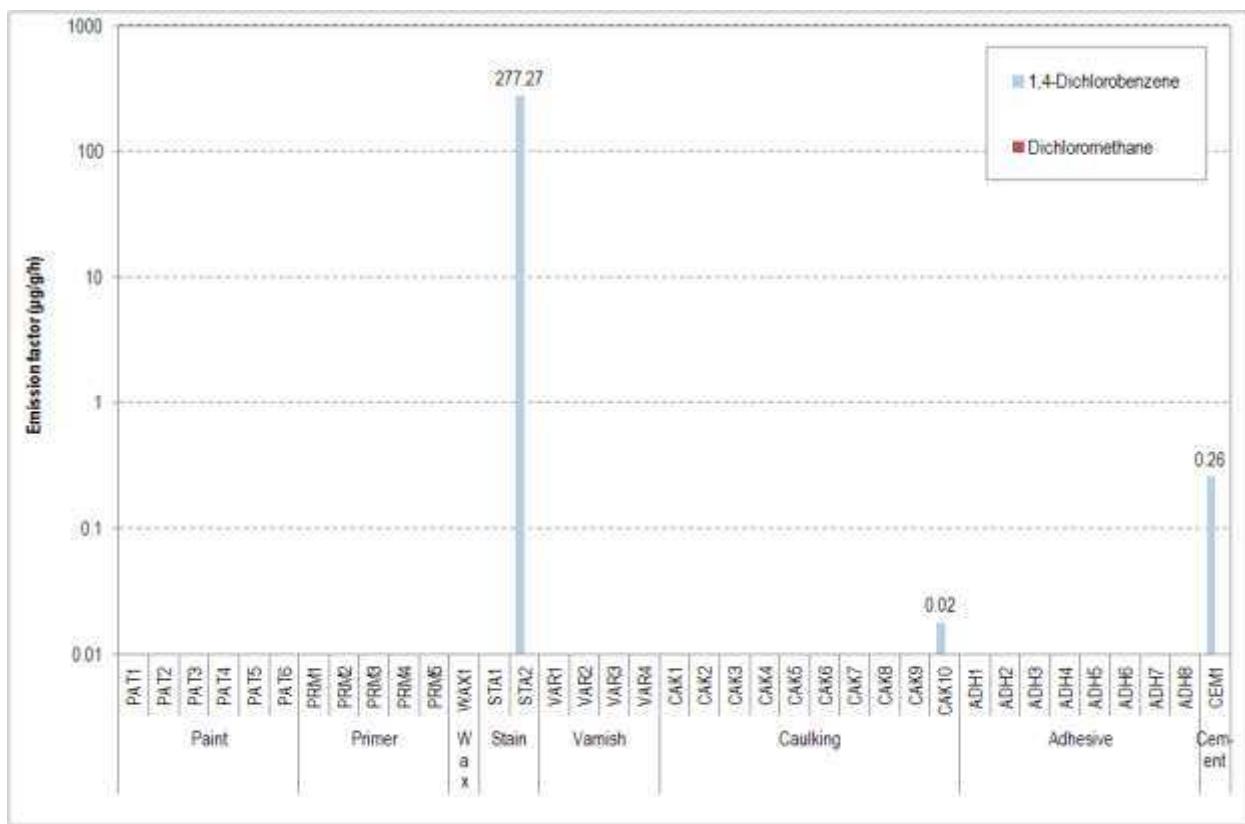


Figure 14: Emission factors for liquid building materials (2 chlorinated compounds)

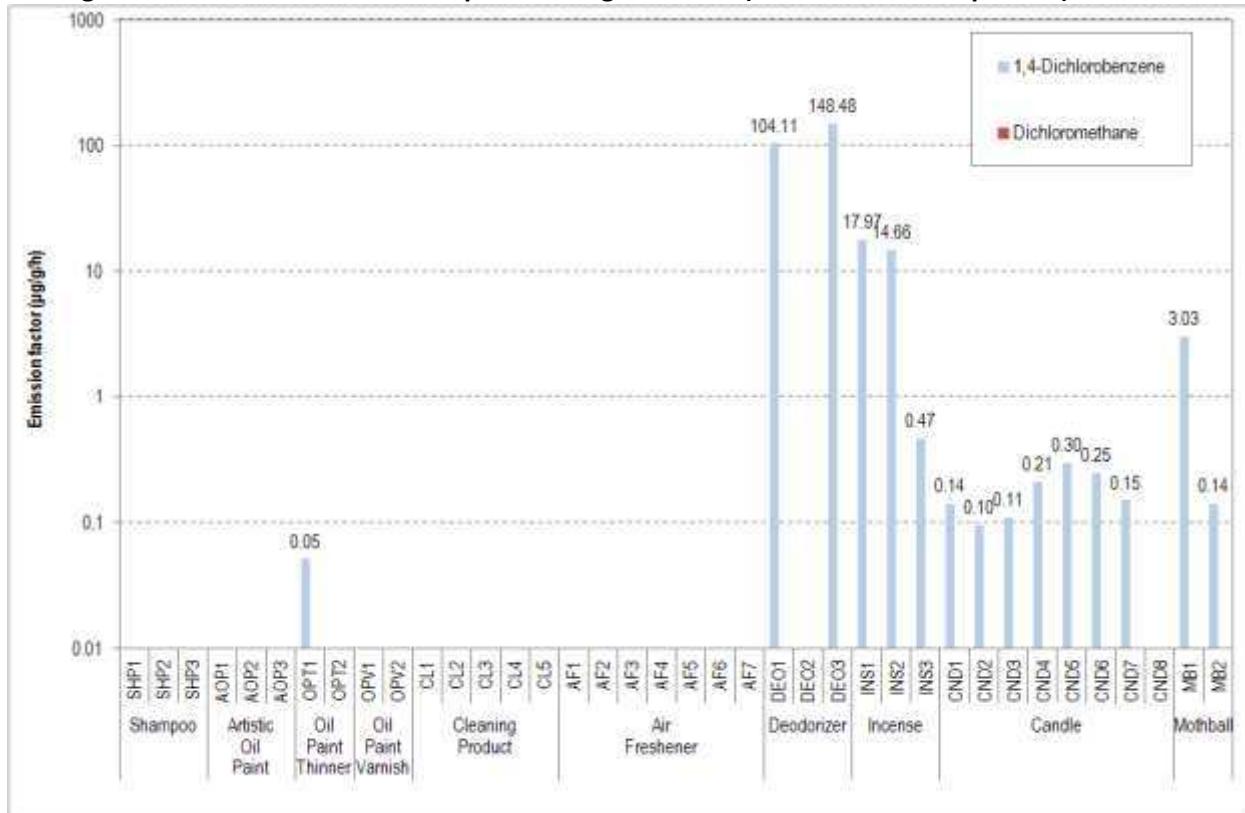


Figure 15: Emission factors for consumer products (2 chlorinated compounds)

3.5 Limitations

While this study produced valuable information that can be useful for identifying sources of VOCs, it had several limitations. Due to the limited time and resource, only one air sample was collected at 1.5 hour for the full-scanning of compounds from each test. Therefore, the emission data presented in this report are likely to have more uncertainties than those of naphthalene, for which the results of 3 samples were averaged.

It should be noted that the test materials were primarily selected with a goal of obtaining naphthalene emission information. While the resulting product list covers a wide range of building materials, furnishings and consumer products, it may not fully represent the whole spectrum of sources that can be found in Canadian homes.

The emission factors reported here should be considered to represent early emissions (0.5 - 2 hours) and should not be compared directly with the conventional emission test results, which tend to measure the emission rates after 24 hours. Even if the air samples are taken after 24 hours in a micro-scale (MS) chamber test, direct comparison with the small-scale (SS) chamber results may not be recommended. For example, Figure 16 shows emission factors measured in the MS and SS chamber with a floor mat specimen for 72 hours under the same conditions provided in Table 3. The emission factors of the MS chamber are consistently higher than those of the SS chamber. This is likely due to the high air exchange rate of the MS chamber compared to that of the SS chamber (1000 vs. 1 /h). A higher air exchange is typically associated with a higher surface air velocity, leading to a higher emission factor. Therefore, the emission factor from the MS and SS chamber should not be compared directly. However, if a correction factor is used, a direct comparison may be possible. Figure 17 compares the emission factors of 8 compounds, which are linear and branched C10 to C11 hydrocarbons, from the same tests mentioned previously. There were good correlations between two chambers. In particular, all samples taken after 1 hour tend to converge to one correlation equation ($SS = 0.5016 * MS$). This implies that the emission factor of the SS chamber can be approximated by multiplying that of the MS chamber with a correction factor of 0.5016. More research is required to determine whether this type of correction factor can be applied to a wide range of compounds and materials.

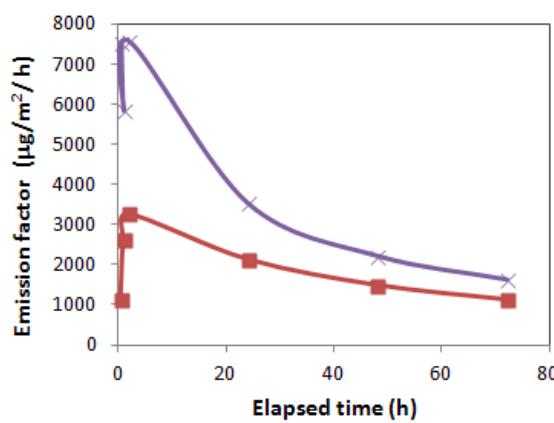


Figure 16: Profiles of emission factors from the MS and SS chamber test

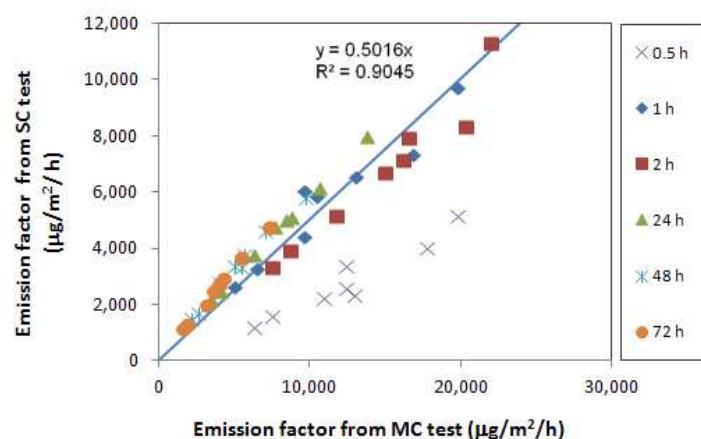


Figure 17: Comparison of emission factors of 8 chemicals in the MS and SS chamber test

4 Conclusions

Material emissions for 72 VOCs were analyzed using air samples taken at 1.5 hour during the fast screening test of naphthalene from 105 specimens, including 61 building materials/furnishings and 44 consumer products. The detection frequency varied widely, ranging from 0 % (alkaloids and some chlorinated compounds) to 87 % (ethylbenzene). The emission factor also showed a large amount of variations with a maximum difference of 10^4 within the solid building materials category and 10^5 within the liquid building materials and consumer products category. The data sets are expected to provide valuable source information for 72 VOCs on the screening level. Using a simple correction factor may provide an opportunity for direct comparison of the micro-scale and small-scale chamber test results.

5 References

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Appendix

A.1 Test materials and products

Table A. 1: Detailed information of test materials and products

Category	Category (detailed)	Test Code	Product	Company	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test
Building materials & products	Flooring (12)	Vinyl flooring (2)	VF1 Natco Vinyl flooring	Natco Products Corp.	Home Depot	N/A	N/A	Dec 16, 2010	Dec 17, 2010
		VF2	Resilient Tile Flooring, Solid Vinyl Tile, Nano-Ceramic Bead Ultimate Performance Finish	Traffic Master	Home Depot	N/A	N/A	"	"
	Carpet (2)	CRP1	Lanart rug soft sisal chocolate, Polypropylene, Soft backing	Lanart rugs	Home Depot	N/A	N/A	Dec 16, 2010	Dec 17, 2010
		CRP2	Encore, Synthetic fiber	Multi home	Home Depot	N/A	N/A	"	"
	Area mat (2)	CRP3	Endurance, Polypropylene top surface with vinyl backing - Charcoal [Indoor/Sheltered outdoor]	Multi home	Home Depot	N/A	N/A	"	"
		CRP4	Endurance, PVC coated polyester filament, Vinyl back [Indoor/Sheltered outdoor]	Multi home	Home Depot	N/A	N/A	"	"

N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Company	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test	
Building materials & furnishings (64)	Flooring (12)	Under pad (2)	UP1	Eco Foam Healthy Home Option, Naturally Hygienic, Carpet & Rug Cushion	PXL Cross Linked Foam	Home Depot	N/A	N/A	Dec 17, 2010	Dec 20, 2010
			UP2	Vita Step Premium Carpet & Rug Pad	The Home Depot	Home Depot	N/A	N/A	"	"
	Flooring composite (4)	ADH2	Composite material Adhesive (ADH2) + Carpet (CRP2)	-	-	N/A	N/A	Dec 16, 2010	Jan 6, 2011	
		CRP2	Composite material Adhesive (ADH3) + Gypsum board (GB)	-	-	N/A	N/A	"	"	
		ADH3	Composite material Adhesive (ADH6) + Laminate flooring (LF)	-	-	N/A	N/A	Dec 16, 2010	Jan 7, 2011	
		GB	Composite material Adhesive (ADH8) + Vinyl flooring (VF1)	-	-	N/A	N/A	Dec 21, 2010	Jan 6, 2011	
		ADH6								
		LF								
		ADH8								
		VF1								
	Cement (2)	Cement board (1)	CB1	DUROCK® Cement Board	Durock	Home Depot	N/E	Zero	Dec 17, 2010	Dec 20, 2010
	Cement (1)	CEM1	PVC Solvent Medium Clear or Gray Cement [Cement for PVC Plastic Pipe]		Home Depot			Dec 16, 2010	Feb 4, 2011	
Furniture (11)	Wooden furniture (6)	FUR1	Accent table [Dark cherry finish, Wood legs]	Home Maison Collection	Canadian Tire	N/A	N/A	Jan 6, 2011	Feb 1, 2011	
		FUR2	Two Shelf Bookcase [Alder Oak Finish]	Mainstays	Walmart	N/A	N/A	"	"	

N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Company	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test	
Building materials & furnishings (64)	Furniture (11)	Wooden furniture (6)	FUR3	Office in a box bureau express [MDF table, PVC covered chair]	Canadian Tire	N/A	N/A	Jan 6, 2011	Feb 1, 2011	
			FUR4	Chelsea Collection, Night Stand	Carina	Walmart	N/A	"	"	
			FUR5	File Cart [Cinnamon Cherry Finish]	SAUDER	Canadian Tire	N/A	"	"	
			FUR6	Night Stand [Espresso finish]	ATRA furniture	Canadian Tire	N/A	"	"	
			FUR7	Saddle stool [Dark walnut finish, Wood legs]	Home Maison Collection	Canadian Tire	N/A	Jan 6, 2011	Feb 4, 2011	
			FUR8	Barstool [padded seat]	Mainstays	Walmart	N/A	"	"	
	Vinyl chair cushion cover (5)		FUR9	Padded black folding chair [polyethylene foam]	COSCO	Walmart	N/A	"	"	
			FUR10	Parsons Chair [walnut finish, black polyurethane cover]	Parsons	Walmart	N/A	"	"	
			FUR11	Buttoned Cushion Ottoman [Black polyurethane cover (PU)]	Mainstays	Walmart	N/A	"	"	

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test
Building materials & furnishings (64)	Paint (6)	Oil-based	PAT1	Paint, Premium Plus Int Ultra Satin Enamel Paint UPW No.7750 - Ultra pure white [Interior]	Home Depot	N/E	Material, g/L: 18 (includes water) Coating, g/L: 44 (excludes water)	Dec 16, 2010 Dec 21, 2010
		Water-based	PAT2	Paint, Bedford Interior Latex SG BASE 1 – Semigloss, White/Base [Interior]	Home Depot	N/E	N/A	" "
	"	PAT3	PermaWhite® Mold & Mildew-Proof Interior Paint – Semi-Gloss	Home Depot	N/E	Less than 50 g/L	" "	" "
		Oil-based	PAT4	Paint, Interior All Living Area - Eggshell [Oil-based, Interior]	Home Depot	N/A	N/A	" "
	"	PAT5	Paint, Premium Plus Interior Eggshell Enamel Upw 2050 – Ultra pure white [Acrylic Latex, Interior]	Home Depot	N/E	Material, g/L: 20 (includes water) Coating, g/L: 48 (excludes water)	" "	" "
	Water-based	PAT6	Paint, Smart3 One Coat Ultra Premium Interior Wash & Wear Protection Any living area Eggshell - Brilliant white [Interior]	Home Depot	N/A	N/A	" "	" "

*N/E: Not Established, N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test
Building materials & furnishings (64)	Primer (5)	Oil-based	PRM1	Primer, white [Oil-based, Interior]	Home Depot	Distillates (petroleum), hydrotreated light; Kerosine-unspecified (64742-47-8): 10-30 Naphtha, petroleum, hydrotreated light (64742-49-0): 10-30	Material, g/L: 443 (includes water) Coating, g/L: 443 (excludes water)	Dec 16, 2010 Dec 22, 2010
	"	PRM2	Spray primer, white [Oil-based, Interior]	Home Depot	Naphtha, petroleum, hydrotreated light (64742-49-0): 5-10	N/A	"	"
	Water-based	PRM3	Primer, Smart3 ANY WHERE Primer – white [Acrylic latex, Water-based, Interior/Exterior]	Home Depot	N/A	Less than 100 g/L	"	"
	Oil-based	PRM4	Multi-Purpose Oil-Based Primer – white [Low Odor, Oil-based, Interior]	Sherwin-Williams	Solvent naphtha, petroleum, light aliphatic (64742-89-8): 3	g/L: 344	"	"
	"	PRM5	A100 Exterior Oil Primer [Oil-based, Exterior]	Sherwin-Williams	N/A	N/A	"	"
Floor/furniture coating (7)	Wax (1)	WAX1	Paste Finishing Wax – Natural [Oil-based]	Home Depot	Mineral Spirits (64742-88-7): 68	g/L: 554	Dec 16, 2010	Dec 23, 2010

*N/E: Not Established, N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test
Building materials & furnishings (64)	Floor/furniture coating (7)	Wood stain (2)	STA1 Premium Wood Stain - Pickled Oak [Oil-based]	Home Depot	N/A	N/A	Dec 16, 2010	Dec 23, 2010
		STA2	WOOD FINISH® - Ebony [Oil-based]	Home Depot	Mineral Spirits (64742-88-7): 50-56 Mineral Spirits (Odorless, 64741-65-7): 4-5 Heavy Naphthenic Petroleum Oil (64742-52-5): 6-9 Highly refined Naphthenic Oil (64742-53-6): 6-9	lb/gal: 4.0-4.3	"	"
	Varnish (4)	VAR1	Sun Blocking Super Spar Varnish [Interior/Exterior Wood, Oil-based]	Home Depot	N/A	Less than 100 g/L	Dec 16, 2010	Dec 22, 2010
		VAR2	Fast-Drying Polyurethane - Clear Gloss [Oil-based]	Home Depot	N/A	N/A	Dec 16, 2010	Dec 23, 2010
		VAR3	Fast-Drying Polyurethane - Clear Semi-Gloss [Oil-based]	Home Depot	N/A	N/A	"	"
		VAR4	Fast-Drying Professional Clear Finish [Oil-based]	Home Depot	N/A	N/A	"	"

*N/E: Not Established, N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Company	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test	
Building materials & furnishings (64)	Caulking (10)	Window /door caulking	CAK1	Alex Plus Acrylic Latex Caulk Plus Silicone - White [Window/Door]	DAP Inc.	Home Depot	Ester Branched & Linear (PHTHALATE ESTER): 1-5	g/L: 39.1 WT%: 1.7	Dec 16, 2010	Jan 4, 2011
			CAK2	Dynaflex 230 - Clear [Window/Door]	DAP Inc.	Home Depot	N/E	g/L: 48.8 WT%: 2.61	Dec 16, 2010	Jan 5, 2011
	Roof caulking	CAK3	Water-proof Roof Sealant - Black [Roof]	DAP Inc.	Home Depot	N/A	N/A	"	"	
	Kitchen/bath caulking	CAK4	DAP Kwik Seal Plus Premium Kitchen and Bath Adhesive Caulk [Kitchen/Bath]	DAP Inc.	Home Depot	Petroleum distillates (64741-88-4): 1-5	g/L: 54.8 WT%: 2.87	Dec 16, 2010	Jan 4, 2011	
	Window /door caulking	CAK5	Ge Silicone II, 2x Stretch 1 Hour Rain-Ready Permanently Waterproof - White [Window/Door/Attic/Basement]	General Electrics	Home Depot	N/A	N/A	"	"	
	Kitchen/bath caulking	CAK6	GE Silicone II - White [Kitchen/Bath]	General Electrics	Home Depot	N/A	N/A	"	"	
	Multi-purpose	CAK7	101000 MULCO [Exterior]	SICO Inc.	Home & Garden	N/E	Coating VOC, g/L: 372.8	Dec 16, 2010	Jan 5, 2011	
		CAK8	LEPAGE PL 200 Construction Adhesive	Henkel Canada Corp.	Home Depot	Solvent naphtha, petroleum, light aliphatic (64742-89-8) 10-30	N/A	"	"	
		CAK9	LEPAGE PL Acoustic-Seal, Vapour Barrier & Sound Reduction Adhesive	Henkel Canada Corp.	Home Depot	N/A	N/A	"	"	
		CAK10	PL Premium Construction Adhesive	Henkel Canada Corp.	Home Depot	Hydrotreated Middle Petroleum Distillates (64742-46-7): 5-10	N/A	"	"	

*N/E: Not Established, N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Company	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test	
Building materials & furnishings (64)	Adhesives (8)	Flooring adhesive	ADH1	Roberts 7200 Superior Wall Base Adhesive [Solvent free, Zero VOCs]	Roberts Company Canada Ltd.	Home Depot	N/E	Coating VOC, g/L: 0	Dec 16, 2010	Jan 7, 2011
			ADH2	Roberts 6700 Premium Indoor/Outdoor Carpet Adhesive	Roberts Company Canada Ltd.	Home Depot	N/E	So low as to be indeterminate	Dec 16, 2010	Jan 6, 2011
	Tile adhesive	ADH3	OmniGrip Maximum Strength Adhesive	Custom Building Products	Home Depot	Distillates (petroleum), hydrotreated light (64742-47-8): 1-5	g/L: 33	"	"	
			ADH4	Premixed Adhesive and Grout	Custom Building Products	Home Depot	N/E	WT%: 2	Dec 16, 2010	Jan 7, 2011
	Multi-purpose	ADH5	Weldbond Universal Adhesive	Frank T Ross and Sons Ltd	Home Depot	N/E	g/L: 9 WT%: 0.9	"	"	
	Flooring adhesive	ADH6	Roberts 1406 Engineered Wood/Laminate Tongue and Groove Adhesive	Roberts Company Canada Ltd.	Home Depot	N/E	g/L: 7.06	"	"	
	Multi-purpose	ADH7	LEPAGE NO MORE NAILS adhesive [Gap filling]	Henkel Canada Corp.	Home Depot	N/E	N/A	"	"	
	Flooring adhesive	ADH8	Roberts 3300 Max Performance + Premium M/P Carpet & Sheet Vinyl Adhesive	Roberts Company Canada Ltd.	Home Depot	N/E	As low as to be indeterminate	Dec 21, 2010	Jan 6, 2011	

*N/E: Not Established, N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Company	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test
Personal care products (3)	Shampoo (coal-tar containing) (3)	SHP1	Polytar Regular Shampoo-Medicated shampoo for dandruff, seborrhea, psoriasis, and itching scalp [1% w/w Polytar]	STIEFEL	Walmart	Polytar: 1	N/A	Jan 6, 2011	Jan 10, 2011
			Tersa-Tar Therapeutic Shampoo [3 % Tar Distillate, 3 % in a soapless, alkaline-free base]	Tersa-Tar	Walmart	Tar Distillate: 3	N/A	"	"
		SHP3	Neutrogena T/Gel therapeutic shampoo, Original Formula, Coal tar shampoo	Johnson & Johnson Inc.	Shoppers Drug Mart	Coal tar: 0.5	N/A	"	"
Consumer products (42)	Art paint (7) Artistic oil paint (3)	AOP1	Daler Rowney Oil Paint - White	Daler-Rowney Ltd,	Walmart	N/A	N/A	Jan 6, 2011	Jan 10, 2011
		AOP2	Tulip, Glow in the Dark, Dimensional Fabric Paint, Natural Glow	Duncan Enterprises	Walmart	N/A	N/A	"	"
		AOP3	Spray Glitter - Silver	FloraCraft	Walmart	N/A	N/A	"	"

*N/E: Not Established, N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Company	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test
Consumer products (42)	Artistic oil paint (7) Thinner (2)	Oil paint Thinner (2)	OPT1 Mona Lisa Odorless Paint Thinner [All types of artist oil, oil based paints, and varnishes]	Speedball Art Products	Walmart	Naphtha, Petroleum, Heavy Alkylate (64741-65-7): 99-100	N/A	Jan 6, 2011	Jan 11, 2011
		OPT2	Grumbacher, Gum Spirits of Turpentine [Oil painting medium and solvent for cleaning brushes]	Grumba-cher	Walmart	N/E	N/A	"	"
		OPV1	Oil paint Varnish (2) Damar Varnish [To improve adhesion when fresh oil colour is applied to a dry painting]	Daler-Rowney Ltd,	Walmart	N/E	N/A	Jan 6, 2011	Jan 11, 2011
		OPV2	FolkArt Clearcote Extra Thick Glaze [Glossy finish for art, craft, or hobby project]	Plaid	Walmart	N/E	N/A	"	"

*N/E: Not Established, N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Company	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test
Consumer products (42)	Cleaning product (5)	Multi-purpose	CL1	Pledge Clean & Dust - Lavender [Streak-free, No residue, Multi Surface]	SC Johnson and Son Limited	Canadian Tire	N/A	Jan 6, 2011	Jan 11, 2011
		Degreaser	CL2	Weiman Leather cleaner & polish naturally cleans, moisturizes and protects leather	Weiman Products, LLC	Canadian Tire	N/A	"	"
			CL3	Husky 910 Industrial strength Spray & Wipe Cleaner Degreaser	Canberra Corp.	Canadian Tire	N/A	Jan 6, 2011	Jan 12, 2011
			CL4	Ronsonol Lighter Fuel, Excellent for Removing labels, grease, tar, oil stains	Zippo Manufacturing Co.	Canadian Tire	Naphtha, petroleum, hydrotreated light (64742-49-0): 30	N/A	"
	Multi-purpose	CL5	Home & Office Cyber Clean, High-tech cleaning compound for all electronic devices, [Non-toxic-Biodegradable]	CyberClean Americas Ltd.	Canadian Tire	N/E	WT%: 8.1 g/L: 268	"	"
Air freshener (7)	Scented oil plug-in	AF1	Air Wick Scented Oil Refill	Reckitt Benckiser Inc.	Walmart	N/A	N/A	Jan 6, 2011	Jan 12, 2011
		AF2	glade plug-ins, scented oil	SC Johnson	Walmart	N/A	N/A	"	"
	Liquid fragrance diffuser	AF3	Febreze set & refresh, Air freshener	Procter & Gamble Inc.	Walmart	N/A	N/A	"	"
	Scented reed diffuser	AF4	The Fragrance Collection by glade, Sheer White Cotton, scented reed diffuser	SC Johnson	Walmart	N/A	N/A	Jan 6, 2011	Jan 19, 2011
		AF5	The Fragrance Collection by glade, currant & ACAI, scented reed diffuser	SC Johnson	Walmart	N/A	N/A	"	"

*N/E: Not Established, N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Company	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test
Consumer products (42)	Air freshener (7)	Scented gel	AF6 After The Rain, Renuzit Aroma, Air freshener	The Dial Corporation A Henkel Co.	Walmart	N/A	N/A	Jan 6, 2011	Jan 19, 2011
			AF7 Pop 'N Fresh, Fragrance	BSI	Dollarama	N/A	N/A	"	"
Deodorizers (3)	Deodorant block	DEO1	Parazene deodorizer, Pleasantly Scented	Recochem Inc.	Dollarama	1,4-dichlorobenzene (106-46-7): 100	N/A	Jan 6, 2011	Jan 20, 2011
		DEO2	Ocean Breeze, closet freshener	Recochem Inc.	Dollarama	1,4-dichlorobenzene (106-46-7): 100	N/A	"	"
		DEO3	Fresh-o-bowl, PARA-ZENE, Ocean Breeze, Deodorizer for toilet bowls and garbage cans	Recochem Inc.	Dollarama	1,4-dichlorobenzene (106-46-7): 100	N/A	"	"
Incense (3)	Incense stick	INS1	Gonesh Sticks, Cinnamon, Extra Rich, incense	Genieco Inc.	Walmart	N/A	N/A	Jan 6, 2011	Jan 20, 2011
		INS2	Gonesh Sticks, Love, Musk, Honeysuckle, incense	Genieco Inc.	Walmart	N/A	N/A	"	"
		INS3	Aromessence, incense, Russian musk	Dollarama	Dollarama	N/A	N/A	"	"

*N/E: Not Established, N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Company	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test	
Consumer products (42)	Candle (8)	Scented candle	CND1	Watson's candles, Lavender	Dollarama	Dollarama	N/A	N/A	Jan 6, 2011	Jan 21, 2011
	"	CND2	Sweet Lavender, 2.8in.W X 4 in. H/7 cm X 10 cm	Mainstays	Walmart	N/A	N/A	Jan 6, 2011	Jan 24, 2011	
	"	CND3	Destination, Tahitian Tropics, vanilla bean, good grade fully refined fine wax, vegetable derived ingredients employed	Green Living, The Fern Group LTD.	Walmart	N/A	N/A	"	"	
	"	CND4	Tealights, Mulled Cider [no lead]	Mainstays	Walmart	N/A	N/A	"	"	
	Unscented candle	CND5	Votive Candles [general household and emergency use]	Dollarama	Dollarama	N/A	N/A	"	"	
	Scented candle	CND6	Candles, Vanilla	Mainstays	Walmart	N/A	N/A	"	"	
	Unscented candle	CND7	Fern, unscented tealights	The Fern Group LTD.	Walmart	N/A	N/A	"	"	
	"	CND8	Decoflam, lamp oil [99% pure paraffin]	Lembex Import		N/A	N/A	"	"	

*N/E: Not Established, N/A: Not Available

Table A. 1: Detailed information of test materials and products (continued)

Category	Category (detailed)	Test Code	Product	Company	Retail outlet	Possible naphthalene containing substance WT%	VOC content	Date of purchase	Date of test
Consumer products (42)	Mothball (2)	MB1	Naphthalene Moth balls	Recochem Inc.	Walmart	Naphthalene (91-20-3) : 100	N/A	Jan 6, 2011	Feb 3, 2011
		MB2	Naphthalene Moth balls	Recochem Inc.	Dollarama	Naphthalene (91-20-3) : 100	N/A	"	"
Foam (6)	Foam mat	FOM1	Connect-A-Mat	Connect-A-World	Walmart	N/A	N/A	Dec 17, 2010	Dec 20, 2010
		FOM2	Yoga Mat 61x173 cm, BP25 3mm thick	North 49	Walmart	N/A	N/A	Jan 6, 2011	Jan 21, 2011
Foam toy	FOM3	Foam soccer ball - Poof Spider	Poof-Slinky.Inc	Walmart	N/A	N/A	"	"	"
	FOM4	Foam Football	Poof-Slinky.Inc	Walmart	N/A	N/A	"	"	"
	FOM5	Bath Toys [Phalate free]	Dollarama	Dollarama	N/A	N/A	"	"	"
	FOM6	Pink foam chair		Walmart	N/A	N/A	"	"	"

*N/E: Not Established, N/A: Not Available

A.2 Emission factors of the NRC target compounds for 105 materials and products

Table A. 2: Emission factor for solid building materials (vinyl flooring, carpet, cement board, under-pad and flooring-adhesive composites)

#	Class	CAS#	Compound	No.	1	2	3	4	5	6	7	8	9	10	11	12	13
				Category	Vinyl Flooring				Carpet				Underpad				CementB
				Code	VF1	VF2	CRP1	CRP2	CRP3	CRP4	UP1	UP2	ADH2CRP2	ADH3GB	ADH6LF	ADH8VF1	CB1
1	Alcohols	71-36-3	1-Butanol		108.4										1784.8		
2		71-23-8	1-Propanol														
3		104-76-7	2-Ethyl-1-hexanol		9.9	641.2	13.2	6.7									1264.0
4		67-63-0	2-Propanol													62309.7	
5		64-17-5	Ethanol		0.5				0.6						10183.2	1098.6	3.5
6		108-95-2	Phenol		10.8	37.7	7.2			267.3	12.8	44.5	35.1		24.5	11.9	6.9
7	Aldehydes & ketones	78-93-3	2-Butanone			485.1			11.3						123.7		5.4
8		108-10-1	4-Methyl-2-pentanone			8.9											
9		67-64-1	Acetone		6.7	21.9	5.3	3.6	5.0	5.1	16.6	12.1	83.6	212.7	303.3	330.9	17.3
10		100-52-7	Benzaldehyde		18.3	17.8											
11		123-72-8	Butanal		9.5										48.1		
12		112-31-2	Decanal														
13		111-71-7	Heptanal														
14		66-25-1	Hexanal														
15		124-19-6	Nonanal		19.0												
16		110-62-3	Pentanal														
17	Aliphatic hydrocarbons	540-84-1	2,2,4-Trimethylpentane														
18		108-08-7	2,4-Dimethylpentane														
19		124-18-5	Decane		114.4	1.5	5.8	4.7			5.5	12.5	42.4	18586.3	14.4	117.4	2.4
20		112-40-3	Dodecane		11.1		7.5	6.0	514.8		6.7	8.4		312.1		18.6	44.0
21		142-82-5	Heptane												161.8	39.7	
22		544-76-3	Hexadecane						5.3								
23		110-54-3	Hexane														
24		111-84-2	Nonane		34.0								12.1	13951.7	9.4	25.1	
25		111-65-9	Octane					4.7							2185.9		
26		629-62-9	Pentadecane		5.7	7.4	19.0	13.3	17.3	2.8							
27		629-59-4	Tetradecane		6.1	8.9	5.7	4.3	29.1	3.3		4.7				13.9	7.9
28		629-50-5	Tridecane		3.7				5.8	12.4	8.5						7.3
29		1120-21-4	Undecane		36.9		8.7	8.3	834.1		7.8	10.0	33.6	7706.5		40.0	25.0
30	Aromatic hydrocarbons	1121-55-7	3-ethenylpyridine *														
31		54-11-5	Nicotine														
32	Aromatic hydrocarbons	526-73-8	1,2,3-Trimethylbenzene		23.4		1.1	1.1	7.9			2.5	6.0	3900.6		30.2	5.8
33		95-93-2	1,2,4,5-Tetramethylbenzene		3.0		0.5	0.5	15.0			0.9		254.1		3.6	56.2
34		95-63-6	1,2,4-Trimethylbenzene		41.3	1.0	2.8	2.4	9.0	0.3	1.7	6.5	17.0	8854.0	9.1	65.9	1.3
35		95-47-6	1,2-dimethylbenzene		3.1	25.5	1.6	1.4	2.8			4.5	6.5	1622.5	32.1	480.3	
36		108-38-3	1,3(4)-dimethylbenzene		2.6	45.3	7.8	5.5	9.2		2.7	20.0	12.9	2800.0	36.6	4868.1	2.1
37		108-67-8	1,3,5-Trimethylbenzene		22.3	0.6	0.8	0.7	4.4		0.7	2.4		2560.4	4.1	27.9	

Table A. 2 (continued)

#	Class	CAS#	Compound	No.	1	2	3	4	5	6	7	8	9	10	11	12	13
				Category	Vinyl Flooring		Carpet				Underpad		Flooring & adhesive composite				CementB
				Code	VF1	VF2	CRP1	CRP2	CRP3	CRP4	UP1	UP2	ADH2CRP2	ADH3GB	ADH6LF	ADH8VF1	CB1
38	Aromatic hydrocarbons	611-14-3	2-Ethyltoluene		28.6	0.6	0.6	0.5	5.0		0.5	1.8	2.0	1946.3		26.8	0.3
39		620-14-4	3-Ethyltoluene		25.6	1.1	1.4	1.2	9.9		0.8	3.7	8.8	4508.1	2.9	37.4	
40		622-96-8	4-Ethyltoluene		9.9	0.4	0.9	1.0	6.8		0.5	2.4	4.6	1988.2		14.1	
41		71-43-2	Benzene												367.7	7.9	
42		100-41-4	Ethylbenzene		0.8	15.8	2.2	1.6	3.2		0.6	5.2	10.4	964.8	8.2	1029.0	0.6
43		100-42-5	Styrene			1.7	12.6	1.7			0.8	13.4	900.6		4.8	35.2	
44		108-88-3	Toluene		2.3	1540.1	5.9	4.0	28.0		3.2	14.6		218.3		3.6	
45		111-15-9	2-Ethoxyethyl acetate														
46	Esters	123-86-4	Butyl acetate		382.0	12.6										526.6	
47		141-78-6	Ethyl acetate												67.7	879.6	
48		25265-77-4	Texanol **		9.2												
49		6846-50-0	TXIB ***		1162.1	19.7	2.7	93.8	5.4	126.4	19.9	2.8			2941.8	18.1	
50	Glycol ethers	107-98-2	1-Methoxy-2-propanol														
51		112-34-5	2-(2-Butoxyethoxy) ethanol							535.1							
52		111-76-2	2-Butoxyethanol														
53		110-80-5	2-Ethoxyethanol														
54		109-86-4	2-Methoxyethanol														
55		5131-66-8	Propylene glycol monobutyl ether														
56	Halo carbons	71-55-6	1,1,1-Trichloroethane														
57		95-50-1	1,2-Dichlorobenzene									11.2					
58		107-06-2	1,2-Dichloroethane														
59		78-87-5	1,2-Dichloropropane														
60		106-46-7	1,4-Dichlorobenzene								1.3	2.8					
61		75-27-4	Bromodichloromethane														
62		56-23-5	Carbon tetrachloride														
63		67-66-3	Chloroform														
64		124-48-1	Dibromochloromethane														
65		75-09-2	Dichloromethane														
66		79-34-5	1,1,2,2-Tetrachloroethane														
67		127-18-4	Tetrachloroethylene														
68		79-01-6	Trichloroethylene														
69	Terpenes	80-56-8	α -Pinene			2.1	15.1	11.4	5.8		27.3	55.5	72.2		23.1	3.4	
70		127-91-3	β -Pinene				3.7	2.4			6.3	14.3	18.2				
71		79-92-5	Camphene														
72		138-86-3	Limonene				13.5	11.0			10.3	33.3	66.6				

Note: * 3-ethenylpyridine is calibrated against 4-ethenylpyridine (100-43-6), ** Texanol (2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate)
*** TXIB (2,2,4-Trimethyl-1,3-pentanediol diisobutyrate), The level below the method detection limit (MDL) is highlighted in blue.

Table A.3: Emission factor for solid building materials and furnishings (furniture)

			No.	14	15	16	17	18	19	20	21	22	23	24
			Category	Furniture										
			Code	FUR1	FUR2	FUR3	FUR4	FUR5	FUR6	FUR7	FUR8	FUR9	FUR10	FUR11
#	Class	CAS#	Compound	(ug/m ² /h)										
1	Alcohols	71-36-3	1-Butanol						17.8					
2		71-23-8	1-Propanol											
3		104-76-7	2-Ethyl-1-hexanol			17.7					7.5		9.6	8.9
4		67-63-0	2-Propanol	38.0	20.9	11.2		11.3	38.7					
5		64-17-5	Ethanol		6.1	4.7	2.5	3.6	5.7	396.1				
6		108-95-2	Phenol		11.2	6.4	6.5	6.0	36.3	6.1	25.2		6.5	138.4
7	Aldehydes & ketones	78-93-3	2-Butanone		6.4	4.9		6.0	4.8	13.8	11.4	6.5	6.4	59.0
8		108-10-1	4-Methyl-2-pentanone											
9		67-64-1	Acetone		182.9	236.3	125.9	39.9	235.3	231.7	19.1	9.4	9.6	23.8
10		100-52-7	Benzaldehyde			16.9			14.5					
11		123-72-8	Butanal											
12		112-31-2	Decanal											
13		111-71-7	Heptanal		30.4	17.4			44.4					
14		66-25-1	Hexanal		584.2	1288.1	62.4	21.5	502.8					
15		124-19-6	Nonanal			10.9	5.1		22.8					7.2
16		110-62-3	Pentanal			59.9	206.1	9.9	57.1					
17	Aromatic hydrocarbons	540-84-1	2,2,4-Trimethylpentane											
18		108-08-7	2,4-Dimethylpentane											
19		124-18-5	Decane		2.9		4.0		4.9	5.4	6.3	10.6	1.7	8.0
20		112-40-3	Dodecane			2.3				19.6	11.1	8.9	4.8	11.4
21		142-82-5	Heptane			10.2								
22		544-76-3	Hexadecane										7.9	4.4
23		110-54-3	Hexane											
24		111-84-2	Nonane				2.2			2.6				2.6
25		111-65-9	Octane		11.7	16.8				14.4				
26		629-62-9	Pentadecane							3.0				
27		629-59-4	Tetradecane						8.5	6.8	7.2	6.6	4.8	28.8
28		629-50-5	Tridecane								11.6	3.9		20.4
29		1120-21-4	Undecane		4.3	4.5	4.4	5.2	6.2	4.7	12.8	14.3	6.4	12.4
30	Alkaloids	1121-55-7	3-ethenylpyridine *											
31		54-11-5	Nicotine											
32	Aromatic hydrocarbons	526-73-8	1,2,3-Trimethylbenzene		11.5	0.9	1.2	1.0	1.9	9.6	16.3	2.9	1.1	6.8
33		95-93-2	1,2,4,5-Tetramethylbenzene		61.8		0.6	0.5	0.4		6.3	3.1	0.7	64.9
34		95-63-6	1,2,4-Trimethylbenzene		9.8	1.7	1.9	1.5	3.5	12.4	36.2	3.8	1.3	11.2
35		95-47-6	1,2-dimethylbenzene		45.2		2.8	2.6	2.0	47.2	3.3	2.2	1.7	4.0
36		108-38-3	1,3(4)-dimethylbenzene		78.9	3.4	5.3	5.0	5.2	80.4	4.8	5.5	5.7	6.7
37		108-67-8	1,3,5-Trimethylbenzene		6.9	1.3	1.0	0.9	2.0	12.6	10.7	1.6	0.5	3.7

Table A. 3 (continued)

			No.	14	15	16	17	18	19	20	21	22	23	24	
			Category	Furniture											
			Code	FUR1	FUR2	FUR3	FUR4	FUR5	FUR6	FUR7	FUR8	FUR9	FUR10	FUR11	
#	Class	CAS#	Compound	(ug/m ² /h)											
38	Aromatic hydrocarbons	611-14-3	2-Ethyltoluene		2.2	0.7	0.9	0.6	1.4	1.7	5.5	1.4	0.4	3.1	0.9
39		620-14-4	3-Ethyltoluene		2.4	1.3	1.8	1.0	2.3	1.7	6.9	2.5	0.9	4.8	1.6
40		622-96-8	4-Ethyltoluene		1.3	0.8		0.6	1.6	0.9	5.4	1.5	0.5	2.5	1.0
41		71-43-2	Benzene		5.1		8.4			6.5				24.3	
42		100-41-4	Ethylbenzene		33.9	1.4	1.7	1.7	1.4	14.2	2.3	2.0	0.9	2.3	0.7
43		100-42-5	Styrene		26.1	1.6	3.1	2.1	3.8	17.0	2.1	2.6	5.8	4.0	
44		108-88-3	Toluene		27.8	8.5	238.3	3.8	14.1	40.3	17.6	11.9	2.7	4.9	2.9
45	Esters	111-15-9	2-Ethoxyethyl acetate		23.1										
46		123-86-4	Butyl acetate		30.0	11.3	7.8				8.5				
47		141-78-6	Ethyl acetate							97.0					
48		25265-77-4	Texanol **												
49		6846-50-0	TXIB ***												
50	Glycol ethers	107-98-2	1-Methoxy-2-propanol												
51		112-34-5	2-(2-Butoxyethoxy) ethanol												
52		111-76-2	2-Butoxyethanol								26.0				
53		110-80-5	2-Ethoxyethanol												
54		109-86-4	2-Methoxyethanol												
55		5131-66-8	Propylene glycol monobutyl ether												
56	Halo carbons	71-55-6	1,1,1-Trichloroethane												
57		95-50-1	1,2-Dichlorobenzene												
58		107-06-2	1,2-Dichloroethane												
59		78-87-5	1,2-Dichloropropane												
60		106-46-7	1,4-Dichlorobenzene		36.1	25.0	24.5	3.0	11.4	9.6	152.7	205.3	4.9	177.7	148.8
61		75-27-4	Bromodichloromethane												
62		56-23-5	Carbon tetrachloride												
63		67-66-3	Chloroform												
64		124-48-1	Dibromochloromethane												
65		75-09-2	Dichloromethane		16.7	15.6	42.3	58.4	15.3	16.7					
66		79-34-5	1,1,2,2-Tetrachloroethane												
67		127-18-4	Tetrachloroethylene												
68		79-01-6	Trichloroethylene												
69	Terpenes	80-56-8	α-Pinene		5.6	258.5	50.2	42.3	165.7	6.5	15.8	3.1		2.9	
70		127-91-3	β-Pinene		2.0	30.0	2.7		26.3		11.5			3.3	
71		79-92-5	Camphene			8.8			4.6	4.3			4.5		
72		138-86-3	Limonene		4.8	13.2	8.3	5.8	16.1	11.2	7.6		9.9		12.2

Note: * 3-ethenylpyridine is calibrated against 4-ethenylpyridine (100-43-6), ** Texanol (2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate)

*** TXIB (2,2,4-Trimethyl-1,3-pentanediol diisobutyrate)

The level below MDL is highlighted in blue.

Table A.4: Emission factor for liquid building materials (paint, primer, wax and stain)

#	Class	CAS#	Compound	No.	25	26	27	28	29	30	31	32	33	34	35	36	37	38	
				Category	Paint						Primer						Wax	Stain	
				Code	PAT1	PAT2	PAT3	PAT4	PAT5	PAT6	PRM1	PRM2	PRM3	PRM4	PRM5	WAX1	STA1	STA2	
1	Alcohols	71-36-3	1-Butanol		0.08		0.14	0.89	0.76										
2		71-23-8	1-Propanol							0.31									
3		104-76-7	2-Ethyl-1-hexanol				29.35												
4		67-63-0	2-Propanol																
5		64-17-5	Ethanol		0.03		0.01	0.05	0.02	0.004									
6		108-95-2	Phenol		0.05	0.04	0.08			0.02			0.07						
7	Aldehydes & ketones	78-93-3	2-Butanone		0.03	0.02	0.02	0.83	0.06	0.02	2.13	2.29	0.03		2.03			0.66	
8		108-10-1	4-Methyl-2-pentanone												0.28				
9		67-64-1	Acetone		0.44	0.19	0.18	0.29	0.18	0.32	0.16	5.54	1.42	0.18	0.64		0.99	0.19	
10		100-52-7	Benzaldehyde		0.05	0.09	0.29			0.01			3.31						
11		123-72-8	Butanal					0.92	0.01	0.004									
12		112-31-2	Decanal																
13		111-71-7	Heptanal																
14		66-25-1	Hexanal																
15		124-19-6	Nonanal		0.16														
16		110-62-3	Pentanal					0.23											
17	Aromatic hydrocarbons	540-84-1	2,2,4-Trimethylpentane																
18		108-08-7	2,4-Dimethylpentane																
19		124-18-5	Decane		0.04	0.04	0.04			0.02	313.15	43.82	0.04		673.06	215.16	185.28	1031.40	
20		112-40-3	Dodecane		0.11	0.07	0.03	20.15	1.41	0.01	145.18	58.00	0.09	3.70	89.58	8.90	919.72	59.12	
21		142-82-5	Heptane																
22		544-76-3	Hexadecane																
23		110-54-3	Hexane																
24		111-84-2	Nonane		0.02	0.02	0.01				251.79	253.42		26.09	187.32	289.02	0.46	1166.15	
25		111-65-9	Octane								23.35	79.86		0.39	0.25			0.21	
26		629-62-9	Pentadecane			0.01													
27		629-59-4	Tetradecane				0.02		0.02								0.86	0.12	
28		629-50-5	Tridecane					0.34	0.03		3.78	2.30		0.15	0.36	0.08	4.84	0.47	
29		1120-21-4	Undecane		0.40	0.19	0.07				269.29	55.17	0.11	29.86	66.51	69.84	2265.02	440.09	
30	Aromatic hydrocarbons	1121-55-7	3-ethenylpyridine *																
31		54-11-5	Nicotine																
32		526-73-8	1,2,3-Trimethylbenzene						0.48		0.84	1.02		10.25	3.36	0.21	36.19	7.84	
33		95-93-2	1,2,4,5-Tetramethylbenzene						0.09		0.29	0.19		0.83	4.09	0.04	21.10	0.76	
34		95-63-6	1,2,4-Trimethylbenzene						1.17		1.64	1.62		30.32	8.71	0.80	42.57	16.52	
35		95-47-6	1,2-dimethylbenzene		0.004	0.004	0.14	1.45	0.06	0.004	16.78	16.99	0.03	0.72	37.47	0.83		9.09	
36		108-38-3	1,3(4)-dimethylbenzene		0.01	0.02	0.15	1.64	0.11	0.01	33.41	35.98	0.07	0.53	59.70	2.78		23.87	
37		108-67-8	1,3,5-Trimethylbenzene		0.00		0.001	8.89	0.45	0.0003	1.07	0.70		11.49	3.58	0.75	5.11	8.08	

Table A. 4 (continued)

#	Class	CAS#	Compound	No.	25	26	27	28	29	30	31	32	33	34	35	36	37	38	
				Category	Paint						Primer						Wax	Stain	
				Code	PAT1	PAT2	PAT3	PAT4	PAT5	PAT6	PRM1	PRM2	PRM3	PRM4	PRM5	WAX1	STA1	STA2	
38	Aromatic hydrocarbons	611-14-3	2-Ethyltoluene		0.00		0.01		0.35	0.00	0.51	0.44		9.05	2.61	0.24	2.80	6.28	
39		620-14-4	3-Ethyltoluene		0.00		0.07		0.64	0.00	1.86	1.30	0.02	14.64	5.86	0.80	2.29	16.48	
40		622-96-8	4-Ethyltoluene		0.00		0.05		0.35	0.00	0.90	0.72	0.01	5.62	3.08	0.33	1.12	8.14	
41		71-43-2	Benzene				0.00	0.06			0.02	0.11	0.04					0.58	
42		100-41-4	Ethylbenzene		0.02	0.005	0.37	0.24	0.06	0.01	6.89	7.60	0.09	0.07	8.99	1.13		6.71	
43		100-42-5	Styrene		0.07				0.34	0.02	39.54	37.90	0.15		1.24		0.10	1.41	
44		108-88-3	Toluene		0.01	0.01	0.05	0.03	0.02	0.004								2.06	
45		111-15-9	2-Ethoxyethyl acetate																
46	Esters	123-86-4	Butyl acetate		0.13	0.07		0.19											
47		141-78-6	Ethyl acetate																
48		25265-77-4	Texanol **			0.32			126.92	74.15	0.13		119.51	0.56			1.39		
49		6846-50-0	TXIB ***						0.03	0.22	1.38	0.08		0.24	77.65	0.84		0.08	
50	Glycol ethers	107-98-2	1-Methoxy-2-propanol																
51		112-34-5	2-(2-Butoxyethoxy) ethanol						160.25	52.30	21.61							0.73	
52		111-76-2	2-Butoxyethanol						0.16										
53		110-80-5	2-Ethoxyethanol						0.25										
54		109-86-4	2-Methoxyethanol						2.00										
55		5131-66-8	Propylene glycol monobutyl ether																
56	Halo carbons	71-55-6	1,1,1-Trichloroethane																
57		95-50-1	1,2-Dichlorobenzene																
58		107-06-2	1,2-Dichloroethane																
59		78-87-5	1,2-Dichloropropane																
60		106-46-7	1,4-Dichlorobenzene														277.27		
61		75-27-4	Bromodichloromethane																
62		56-23-5	Carbon tetrachloride																
63		67-66-3	Chloroform																
64		124-48-1	Dibromochloromethane																
65		75-09-2	Dichloromethane																
66		79-34-5	1,1,2,2-Tetrachloroethane																
67		127-18-4	Tetrachloroethylene																
68		79-01-6	Trichloroethylene																
69	Terpenes	80-56-8	α -Pinene																
70		127-91-3	β -Pinene																
71		79-92-5	Camphene																
72		138-86-3	Limonene																

Note: * 3-ethenylpyridine is calibrated against 4-ethenylpyridine (100-43-6), ** Texanol (2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate)

*** TXIB (2,2,4-Trimethyl-1,3-pentanediol diisobutyrate)

The level below MDL is highlighted in blue.

Table A.5: Emission factor for liquid building materials (varnish, caulking)

#	Class	CAS#	Compound	No.	39	40	41	42	43	44	45	46	47	48	49	50	51	52
				Category	Varnish				Caulking									
				Code	VAR1 (ug/g/h)	VAR2 (ug/g/h)	VAR3 (ug/g/h)	VAR4 (ug/g/h)	CAK1 (ug/g/h)	CAK2 (ug/g/h)	CAK3 (ug/g/h)	CAK4 (ug/g/h)	CAK5 (ug/g/h)	CAK6 (ug/g/h)	CAK7 (ug/g/h)	CAK8 (ug/g/h)	CAK9 (ug/g/h)	CAK10 (ug/g/h)
1	Alcohols	71-36-3	1-Butanol		30.38	0.25	0.91	2.61	0.16	2.97	0.02	15.85				43.02		
2		71-23-8	1-Propanol		4.65													
3		104-76-7	2-Ethyl-1-hexanol						0.88	12.33		0.50		0.73	0.31			
4		67-63-0	2-Propanol								35.35					60.56		
5		64-17-5	Ethanol		8.16				38.29	212.10	0.10	1.53			2.95	1288.42		1.18
6		108-95-2	Phenol												0.01			
7	Aldehydes & ketones	78-93-3	2-Butanone			13.01	6.60	19.28			0.02		5.06	3.69			0.05	
8		108-10-1	4-Methyl-2-pentanone							0.20								
9		67-64-1	Acetone		0.33	0.54	0.81	0.60	0.46	2.51	0.61	0.34		0.19	0.24	44.57	0.06	0.04
10		100-52-7	Benzaldehyde							1.19		5.35				9.49		
11		123-72-8	Butanal		16.98	0.16	0.30	3.19										
12		112-31-2	Decanal															
13		111-71-7	Heptanal									0.10						
14		66-25-1	Hexanal							0.18								
15		124-19-6	Nonanal						0.69				0.18					
16		110-62-3	Pentanal					1.00							0.19			
17	Aromatic hydrocarbons	540-84-1	2,2,4-Trimethylpentane															
18		108-08-7	2,4-Dimethylpentane		2.82											0.50		
19		124-18-5	Decane		698.11	672.59	1235.34	1011.80	19.80	0.03	125.78	0.08	0.09	0.36	0.16	0.92	118.79	0.56
20		112-40-3	Dodecane		245.16	94.28	267.75	225.65	3.59		11.87		0.03	0.21		0.66	6.86	0.02
21		142-82-5	Heptane								0.16					305.11	0.19	
22		544-76-3	Hexadecane										0.70					
23		110-54-3	Hexane															
24		111-84-2	Nonane		64.70	688.07	450.70	348.34	8.73	0.01	124.92					166.69	128.05	0.18
25		111-65-9	Octane			19.70	0.21	18.62	1.09		25.09					118.72	18.83	0.04
26		629-62-9	Pentadecane										0.08					
27		629-59-4	Tetradecane			0.06	0.20	0.13										
28		629-50-5	Tridecane		2.37	1.68	6.28	5.80	0.10		0.22				0.07	0.20		
29		1120-21-4	Undecane		683.92	385.22		756.77	16.28	0.02	89.38	0.08		0.22	1.02	77.82	0.18	
30	Alkaloids	1121-55-7	3-ethenylpyridine *															
31		54-11-5	Nicotine															
32	Aromatic hydrocarbons	526-73-8	1,2,3-Trimethylbenzene		2.41	3.18	6.81	6.45	0.02	0.01	17.23			0.05	17.19	24.98	0.07	
33		95-93-2	1,2,4,5-Tetramethylbenzene		0.39	2.96	7.33	1.40			5.78				2.50	5.91	0.01	
34		95-63-6	1,2,4-Trimethylbenzene		5.69				0.01	0.01	56.07			0.21	40.03	64.32	0.17	
35		95-47-6	1,2-dimethylbenzene		1.61	1.18	0.43	11.40	0.00	0.01	22.02	0.96		86.32	97.06	23.40	0.15	
36		108-38-3	1,3(4)-dimethylbenzene		0.14			36.15	0.02	0.06	39.86	2.30		243.99	165.02	40.34	1.36	
37		108-67-8	1,3,5-Trimethylbenzene		2.33	1.12	3.24	4.22		0.01	34.09	0.01		0.08	8.75	37.69	0.12	

Table A. 5 (continued)

#	Class	CAS#	Compound	No.	39	40	41	42	43	44	45	46	47	48	49	50	51	52
				Category	Varnish				Caulking									
				Code	VAR1 (ug/g/h)	VAR2 (ug/g/h)	VAR3 (ug/g/h)	VAR4 (ug/g/h)	CAK1 (ug/g/h)	CAK2 (ug/g/h)	CAK3 (ug/g/h)	CAK4 (ug/g/h)	CAK5 (ug/g/h)	CAK6 (ug/g/h)	CAK7 (ug/g/h)	CAK8 (ug/g/h)	CAK9 (ug/g/h)	CAK10 (ug/g/h)
38	Aromatic hydrocarbons	611-14-3	2-Ethyltoluene		1.08	1.54	2.57	3.32	0.02	0.002	5.93	0.01			0.04	5.93	12.43	0.03
39		620-14-4	3-Ethyltoluene		2.30	3.44	4.59	5.98	0.01		24.66	0.07			0.11	12.66	32.39	0.05
40		622-96-8	4-Ethyltoluene		0.91	1.26	2.64	3.22	0.00		10.75	0.04			0.06	5.53	15.12	0.02
41		71-43-2	Benzene		0.08	0.11	0.05	0.05	0.03	0.02	0.02	0.02	0.02	0.02	0.02	5.66		0.01
42		100-41-4	Ethylbenzene		0.02	1.02	0.13	25.35		0.02	4.78	0.74			131.32	79.33	5.40	0.31
43		100-42-5	Styrene												33.28		0.02	
44		108-88-3	Toluene					0.10			0.45				0.46	354.71	1.28	0.50
45	Esters	111-15-9	2-Ethoxyethyl acetate															
46		123-86-4	Butyl acetate															
47		141-78-6	Ethyl acetate						2.97	1.17	0.04				0.63	2.14		0.53
48		25265-77-4	Texanol **				0.21		13.52			6.17						
49		6846-50-0	TXIB ***				0.13		0.01			0.02						
50	Glycol ethers	107-98-2	1-Methoxy-2-propanol		0.48													
51		112-34-5	2-(2-Butoxyethoxy) ethanol															
52		111-76-2	2-Butoxyethanol		800.73													
53		110-80-5	2-Ethoxyethanol															
54		109-86-4	2-Methoxyethanol															
55		5131-66-8	Propylene glycol monobutyl ether															
56	Halo carbons	71-55-6	1,1,1-Trichloroethane															
57		95-50-1	1,2-Dichlorobenzene										0.01					
58		107-06-2	1,2-Dichloroethane															
59		78-87-5	1,2-Dichloropropane															
60		106-46-7	1,4-Dichlorobenzene															0.02
61		75-27-4	Bromodichloromethane															
62		56-23-5	Carbon tetrachloride															
63		67-66-3	Chloroform															
64		124-48-1	Dibromochloromethane															
65		75-09-2	Dichloromethane															
66		79-34-5	1,1,2,2-Tetrachloroethane															
67		127-18-4	Tetrachloroethylene															
68		79-01-6	Trichloroethylene															
69	Terpenes	80-56-8	α -Pinene												0.09	0.04		
70		127-91-3	β -Pinene										0.02	0.04	0.09			
71		79-92-5	Camphene													2.88	7.00	
72		138-86-3	Limonene															

Note: * 3-ethenylpyridine is calibrated against 4-ethenylpyridine (100-43-6) ** Texanol (2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate)
*** TXIB (2,2,4-Trimethyl-1,3-pentanediol diisobutyrate) The level below MDL is highlighted in blue.

Table A. 6: Emission factor for liquid building materials (adhesive, concrete)

			No.	53	54	55	56	57	58	59	60	61
			Category	Adhesive								Concrete
			Code	ADH1	ADH2	ADH3	ADH4	ADH5	ADH6	ADH7	ADH8	CEM1
#	Class	CAS#	Compound	(ug/g/h)								
1	Alcohols	71-36-3	1-Butanol	0.19		1.81	10.02			10.99		1.44
2		71-23-8	1-Propanol									
3		104-76-7	2-Ethyl-1-hexanol					0.10				
4		67-63-0	2-Propanol						9.44			6.92
5		64-17-5	Ethanol				2.73					
6		108-95-2	Phenol	0.04	1.24		0.01		0.02			66.30
7	Aldehydes & ketones	78-93-3	2-Butanone			0.12					0.56	2152.18
8		108-10-1	4-Methyl-2-pentanone									0.26
9		67-64-1	Acetone	0.08	0.12	0.20	0.18	0.29	1.60	0.52	0.17	1318.27
10		100-52-7	Benzaldehyde	1.32			9.83			7.14		
11		123-72-8	Butanal							0.77		
12		112-31-2	Decanal									
13		111-71-7	Heptanal									
14		66-25-1	Hexanal									
15		124-19-6	Nonanal									
16		110-62-3	Pentanal									0.08
17	Aliphatic hydrocarbons	540-84-1	2,2,4-Trimethylpentane	0.47				0.41				
18		108-08-7	2,4-Dimethylpentane									
19		124-18-5	Decane	0.01	0.05	47.07	0.03	0.03	0.02	0.02	0.27	
20		112-40-3	Dodecane			7.32						0.18
21		142-82-5	Heptane			0.15						
22		544-76-3	Hexadecane									
23		110-54-3	Hexane									
24		111-84-2	Nonane			27.80		0.04				1.26
25		111-65-9	Octane			4.02					0.07	1.01
26		629-62-9	Pentadecane								0.27	
27		629-59-4	Tetradecane								0.47	
28		629-50-5	Tridecane			0.19					0.23	
29		1120-21-4	Undecane	0.03		40.43					0.04	
30	Alkaloids	1121-55-7	3-ethenylpyridine *									
31		54-11-5	Nicotine									
32	Aromatic hydrocarbons	526-73-8	1,2,3-Trimethylbenzene	0.04		6.62		0.01			0.04	
33		95-93-2	1,2,4,5-Tetramethylbenzene			1.09					0.01	
34		95-63-6	1,2,4-Trimethylbenzene	0.06		15.11		0.02			0.09	
35		95-47-6	1,2-dimethylbenzene	0.01		1.85	0.56	0.02		0.02	0.02	1.54
36		108-38-3	1,3(4)-dimethylbenzene	0.01	0.02	3.67	3.03	0.03		0.06	0.03	5.47
37		108-67-8	1,3,5-Trimethylbenzene			3.70				0.002		0.01

Table A. 6 (continued)

			No.	53	54	55	56	57	58	59	60	61
			Category	Adhesive								Concrete
			Code	ADH1	ADH2	ADH3	ADH4	ADH5	ADH6	ADH7	ADH8	CEM1
#	Class	CAS#	Compound	(ug/g/h)								
38	Aromatic hydrocarbons	611-14-3	2-Ethyltoluene	0.02		2.83	0.002	0.003		0.004	0.04	0.01
39		620-14-4	3-Ethyltoluene	0.06		7.18	0.01			0.02	0.09	0.03
40		622-96-8	4-Ethyltoluene	0.04		3.62	0.01			0.01	0.03	0.01
41		71-43-2	Benzene	0.03		0.01		0.02	0.04	0.05	0.03	0.14
42		100-41-4	Ethylbenzene	0.01	0.02	1.30	0.59	0.01		0.07	0.02	1.56
43		100-42-5	Styrene	0.03	2.09						0.23	
44		108-88-3	Toluene									0.32
45	Esters	111-15-9	2-Ethoxyethyl acetate									
46		123-86-4	Butyl acetate	0.07			1.11		0.02	1.05		
47		141-78-6	Ethyl acetate					1.58	0.45			
48		25265-77-4	Texanol **	0.10								
49		6846-50-0	TXIB ***									
50	Glycol ethers	107-98-2	1-Methoxy-2-propanol					21.30				
51		112-34-5	2-(2-Butoxyethoxy) ethanol						3.37			
52		111-76-2	2-Butoxyethanol				1.69					
53		110-80-5	2-Ethoxyethanol									
54		109-86-4	2-Methoxyethanol									
55		5131-66-8	Propylene glycol monobutyl ether									
56	Halo carbons	71-55-6	1,1,1-Trichloroethane									
57		95-50-1	1,2-Dichlorobenzene									
58		107-06-2	1,2-Dichloroethane									
59		78-87-5	1,2-Dichloropropane									
60		106-46-7	1,4-Dichlorobenzene								0.26	
61		75-27-4	Bromodichloromethane									
62		56-23-5	Carbon tetrachloride						0.10			
63		67-66-3	Chloroform									
64		124-48-1	Dibromochloromethane									
65		75-09-2	Dichloromethane									
66		79-34-5	1,1,2,2-Tetrachloroethane									
67		127-18-4	Tetrachloroethylene									
68		79-01-6	Trichloroethylene									
69	Terpenes	80-56-8	α -Pinene		0.22						0.03	
70		127-91-3	β -Pinene		0.05						0.08	
71		79-92-5	Camphene									
72		138-86-3	Limonene	0.26		0.004					0.01	

Note: * 3-ethenylpyridine is calibrated against 4-ethenylpyridine (100-43-6),

** Texanol (2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate)

*** TXIB (2,2,4-Trimethyl-1,3-pentanediol diisobutyrate)

The level below MDL is highlighted in blue.

Table A. 7: Emission factor for consumer products (shampoo, artistic oil paint, thinner, varnish, cleaning product)

#	Class	CAS#	Compound	No.	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76		
				Category	Shampoo			Artistic oil paint			Oil paint thinner			Oil paint varnish			Cleaning product				
				Code	SHP1	SHP2	SHP3	AOP1	AOP2	AOP3	OPT1	OPT2	OPV1	OPV2	CL1	CL2	CL3	CL4	CLS		
1	Alcohols	71-36-3	1-Butanol					1.17			3.98			49.81			2.95	116.54			
2		71-23-8	1-Propanol																		
3		104-76-7	2-Ethyl-1-hexanol												0.03		0.49	0.06			
4		67-63-0	2-Propanol	4.08	750.28	0.68							0.91		621.86	1.02	40.59				
5		64-17-5	Ethanol	246.10	6.06	6.43		148.52	416.67				1992.52		6.55	0.43	4.77		6871.19		
6		108-95-2	Phenol	0.04	0.01	0.03								0.05		0.02	0.03	0.10			
7	Aldehydes & ketones	78-93-3	2-Butanone	0.16	0.04						0.01	8.51	0.08	0.16		0.01	0.10	0.02			
8		108-10-1	4-Methyl-2-pentanone	0.13									0.56								
9		67-64-1	Acetone	0.38	36.86	0.17	0.29	7.47	0.67	0.06	0.78	2.33	15.12	33.50	2.63	3.01	0.24				
10		100-52-7	Benzaldehyde																		
11		123-72-8	Butanal														2.70				
12		112-31-2	Decanal																		
13		111-71-7	Heptanal												0.24						
14		66-25-1	Hexanal												0.29						
15		124-19-6	Nonanal												0.14			0.02			
16		110-62-3	Pentanal																		
17	Aliphatic hydrocarbons	540-84-1	2,2,4-Trimethylpentane								4.71	0.07									
18		108-08-7	2,4-Dimethylpentane				4.86											1.65			
19		124-18-5	Decane	0.02		4.97	0.03						6.32		0.01		2.70				
20		112-40-3	Dodecane		0.03	10.78		0.20	0.12		0.03		0.03		0.03						
21		142-82-5	Heptane										97.36					294.37			
22		544-76-3	Hexadecane																		
23		110-54-3	Hexane																		
24		111-84-2	Nonane			0.18									0.03	0.04	0.02	310.05	0.03		
25		111-65-9	Octane					0.05	0.07	0.03	542.05				0.05	0.05		0.16			
26		629-62-9	Pentadecane	0.04																	
27		629-59-4	Tetradecane				0.30														
28		629-50-5	Tridecane																		
29		1120-21-4	Undecane		0.05	33.28	0.03				1.78	0.18						0.02			
30	Aromatic hydrocarbons	1121-55-7	3-ethenylpyridine *			0.16															
31		54-11-5	Nicotine																		
32		526-73-8	1,2,3-Trimethylbenzene	0.34	4.42	0.18	0.43			0.95			0.31					0.06			
33		95-93-2	1,2,4,5-Tetramethylbenzene	0.01	0.03	0.01	0.03			0.02		0.02	0.04								
34		95-63-6	1,2,4-Trimethylbenzene	0.41	10.92	0.41	0.62			6.33		0.16	1.98		0.05		0.35				
35		95-47-6	1,2-dimethylbenzene	0.08	1.44	0.18	0.10		0.73	34.85			183.81	0.02	0.10	0.05	2.61				
36		108-38-3	1,3(4)-dimethylbenzene	0.27	3.43	0.44	0.11	0.03	7.01	81.01				0.08	0.79	0.41	4.91	0.003			
37		108-67-8	1,3,5-Trimethylbenzene	0.26	4.37	0.31	0.20			3.08			1.50					0.22			

Table A. 7 (continued)

#	Class	CAS#	Compound	No.	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	
				Category	Shampoo			Artistic oil paint			Oil paint thinner		Oil paint varnish		Cleaning product					
				Code	SHP1	SHP2	SHP3	AOP1	AOP2	AOP3	OPT1	OPT2	OPV1	OPV2	CL1	CL2	CL3	CL4	CL5	
38	Aromatic hydrocarbons	611-14-3	2-Ethyltoluene		0.15	3.09	0.12	0.17			2.30			0.89				0.09		
39		620-14-4	3-Ethyltoluene		0.47	10.73	0.59	0.21			7.38	0.19		8.04				0.46		
40		622-96-8	4-Ethyltoluene		0.37	6.21	0.26	0.07			4.00	0.07		2.56				0.15		
41		71-43-2	Benzene		0.19	0.03	0.19	0.14	0.05		0.02	0.01	0.02	0.65		0.02	0.01	0.40		
42		100-41-4	Ethylbenzene		0.04	1.20	0.29	0.02	0.01	1.44	18.14	0.11			0.02	0.16	0.08	2.54	0.002	
43		100-42-5	Styrene		0.07		0.02	0.01						14.35				0.62		
44		108-88-3	Toluene								0.02	1.21	4.92	58.61				1.88		
45		111-15-9	2-Ethoxyethyl acetate																	
46	Esters	123-86-4	Butyl acetate								0.72									
47		141-78-6	Ethyl acetate		1.39								3.12	5.82				1.06		
48		25265-77-4	Texanol **						73.59											
49		6846-50-0	TXIB ***						0.24											
50	Glycol ethers	107-98-2	1-Methoxy-2-propanol											7.10						
51		112-34-5	2-(2-Butoxyethoxy) ethanol																	
52		111-76-2	2-Butoxyethanol											1.92			526.43			
53		110-80-5	2-Ethoxyethanol																	
54		109-86-4	2-Methoxyethanol																	
55		5131-66-8	Propylene glycol monobutyl ether																	
56	Halo carbons	71-55-6	1,1,1-Trichloroethane																	
57		95-50-1	1,2-Dichlorobenzene																	
58		107-06-2	1,2-Dichloroethane																	
59		78-87-5	1,2-Dichloropropane																	
60		106-46-7	1,4-Dichlorobenzene								0.05									
61		75-27-4	Bromodichloromethane																	
62		56-23-5	Carbon tetrachloride																	
63		67-66-3	Chloroform																	
64		124-48-1	Dibromochloromethane																	
65		75-09-2	Dichloromethane																	
66		79-34-5	1,1,2,2-Tetrachloroethane																	
67		127-18-4	Tetrachloroethylene																	
68		79-01-6	Trichloroethylene																	
69	Terpenes	80-56-8	α -Pinene		0.50	0.12	11.65	0.04			0.33	1588.11	866.56		0.02	2.71	2.13	1.84		
70		127-91-3	β -Pinene		0.20	0.10	4.05					265.14	332.37		0.02	2.07	1.30	0.03		
71		79-92-5	Camphene		0.02	0.05	0.47						194.57		0.03	0.06	0.17	0.57		
72		138-86-3	Limonene		41.45	2.26	16.04					297.05	179.13		0.64	163.92	0.79	0.31	0.15	

Note: * 3-ethenylpyridine is calibrated against 4-ethenylpyridine (100-43-6), ** Texanol (2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate)

*** TXIB (2,2,4-Trimethyl-1,3-pentanediol diisobutyrate)

The level below MDL is highlighted in blue.

Table A.8: Emission factor for consumer products (air freshener, deodorizer, incense)

#	Class	CAS#	Compound	No.	77	78	78	80	81	82	83	84	85	86	87	88	89	
				Category	Air Freshener							Deodorizer			Incense			
				Code	AF1	AF2	AF3	AF4	AF5	AF6	AF7	DEO1	DEO2	DEO3	INS1	INS2	INS3	
1	Alcohols	71-36-3	1-Butanol	(ug/g/h)	0.32													
2		71-23-8	1-Propanol		0.09													
3		104-76-7	2-Ethyl-1-hexanol															
4		67-63-0	2-Propanol		0.79											3.96		
5		64-17-5	Ethanol		6.85	4.63	26.12	2.22	24.78	0.48	352.50					8.44	1.12	
6		108-95-2	Phenol		0.03				0.01	0.01			0.004	0.01	0.02	0.03	0.02	
7	Aldehydes & ketones	78-93-3	2-Butanone		0.03		0.07	0.01	0.01								0.48	
8		108-10-1	4-Methyl-2-pentanone															
9		67-64-1	Acetone		1.44	7.39	0.16	0.45	0.28	0.13	0.08		0.04	0.02	0.54	0.44	0.60	
10		100-52-7	Benzaldehyde		3.34		9.32	1.25		1.35	0.07	0.15	1.51	0.90	129.34	347.34		
11		123-72-8	Butanal															
12		112-31-2	Decanal			15.07			16.66		0.38					1.03		
13		111-71-7	Heptanal						0.40							0.12		
14		66-25-1	Hexanal						0.10				0.07		0.08	0.09		
15		124-19-6	Nonanal			0.85		0.04	0.37							0.36		
16		110-62-3	Pentanal						0.92							0.08		
17	Aliphatic hydrocarbons	540-84-1	2,2,4-Trimethylpentane															
18		108-08-7	2,4-Dimethylpentane															
19		124-18-5	Decane		0.13	0.16												
20		112-40-3	Dodecane															
21		142-82-5	Heptane		1.10											4.03		
22		544-76-3	Hexadecane							0.03				0.04				
23		110-54-3	Hexane															
24		111-84-2	Nonane		0.59	1.00	0.04	0.04	0.03				0.003			3.61		
25		111-65-9	Octane		3.77	1.20	0.20	0.02	0.05				0.01			21.46		
26		629-62-9	Pentadecane					0.05	0.01	0.02	0.13	0.03		0.06	0.04			
27		629-59-4	Tetradecane						0.23	0.04	0.03	0.42	0.55		0.08		0.04	
28		629-50-5	Tridecane															
29		1120-21-4	Undecane		0.13	0.19												
30	Alkaloids	1121-55-7	3-ethenylpyridine *															
31		54-11-5	Nicotine															
32	Aromatic hydrocarbons	526-73-8	1,2,3-Trimethylbenzene											0.02		2.56		
33		95-93-2	1,2,4,5-Tetramethylbenzene													0.01		
34		95-63-6	1,2,4-Trimethylbenzene													11.62		
35		95-47-6	1,2-dimethylbenzene			0.51	0.01	0.03			0.002		0.01		0.01		9.40	
36		108-38-3	1,3(4)-dimethylbenzene		0.05	1.55	0.03	0.07	0.01		0.01		0.08	0.002	0.03	0.01	38.88	
37		108-67-8	1,3,5-Trimethylbenzene										0.002				4.34	

Table A. 8 (continued)

#	Class	CAS#	Compound	No.	77	78	78	80	81	82	83	84	85	86	87	88	89
				Category	Air Freshener							Deodorizer			Incense		
				Code	AF1	AF2	AF3	AF4	AF5	AF6	AF7	DEO1	DEO2	DEO3	INS1	INS2	INS3
38	Aromatic hydrocarbons	611-14-3	2-Ethyltoluene					0.01					0.005				0.98
39		620-14-4	3-Ethyltoluene		0.01		0.003	0.004					0.003				5.38
40		622-96-8	4-Ethyltoluene				0.003	0.01					0.001				1.89
41		71-43-2	Benzene		0.01		0.02	0.02	0.01	0.004	0.00	0.00	0.01	0.002	0.01	0.02	0.91
42		100-41-4	Ethylbenzene		0.01	0.39	0.01	0.02	0.01		0.003		0.02		0.01	0.01	8.50
43		100-42-5	Styrene			0.16	0.03	0.004	0.05	0.01	0.01	0.02	0.01	0.01	0.01	0.01	2.25
44		108-88-3	Toluene				0.94										15.12
45	Esters	111-15-9	2-Ethoxyethyl acetate														
46		123-86-4	Butyl acetate									0.01					
47		141-78-6	Ethyl acetate		0.04		0.05	0.03	0.19		0.09						
48		25265-77-4	Texanol **										0.02				
49		6846-50-0	TXIB ***														0.08
50	Glycol ethers	107-98-2	1-Methoxy-2-propanol		5.81	3.63											
51		112-34-5	2-(2-Butoxyethoxy) ethanol														
52		111-76-2	2-Butoxyethanol														
53		110-80-5	2-Ethoxyethanol														
54		109-86-4	2-Methoxyethanol														
55		5131-66-8	Propylene glycol monobutyl ether														
56	Halo carbons	71-55-6	1,1,1-Trichloroethane														
57		95-50-1	1,2-Dichlorobenzene									0.16	1.43	8.13	0.04	0.05	
58		107-06-2	1,2-Dichloroethane														
59		78-87-5	1,2-Dichloropropane														
60		106-46-7	1,4-Dichlorobenzene									104.11		148.48	17.97	14.66	0.47
61		75-27-4	Bromodichloromethane														
62		56-23-5	Carbon tetrachloride														
63		67-66-3	Chloroform														
64		124-48-1	Dibromochloromethane														
65		75-09-2	Dichloromethane														
66		79-34-5	1,1,2,2-Tetrachloroethane														
67		127-18-4	Tetrachloroethylene														
68		79-01-6	Trichloroethylene														
69	Terpenes	80-56-8	α -Pinene		3.13	62.11	1.84	2.73	19.11	0.01	0.03	0.07	0.07	0.18	4.89	0.31	
70		127-91-3	β -Pinene		15.28	127.44	0.42	1.55	9.66	0.07	0.12	0.01	0.01	0.02	2.14	0.45	
71		79-92-5	Camphene		0.12	3.04	0.32	0.52	0.17		0.004		0.61	0.17	0.23	0.03	0.05
72		138-86-3	Limonene		32.52	898.30	1.64	100.03	351.45	0.06	1.07	0.13	0.51	0.79	9.50	96.93	0.03

Note: * 3-ethenylpyridine is calibrated against 4-ethenylpyridine (100-43-6), ** Texanol (2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate)

*** TXIB (2,2,4-Trimethyl-1,3-pentanediol diisobutyrate)

The level below MDL is highlighted in blue.

Table A. 9: Emission factor for consumer products (candle, mothball, foam product)

#	Class	CAS#	Compound	No.	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105		
				Category	Candle								Mothball		Foam							
				Code	CND1	CND2	CND3	CND4	CND5	CND6	CND7	CND8	MB1	MB2	FOM1	FOM2	FOM3	FOM4	FOM5	FOM6		
1	Alcohols	71-36-3	1-Butanol											0.13					8.33			
2		71-23-8	1-Propanol																			
3		104-76-7	2-Ethyl-1-hexanol			0.40								11.25	919.05		17.15	50.69				
4		67-63-0	2-Propanol																			
5		64-17-5	Ethanol		0.01				0.02						1.20	0.53		1.10				
6		108-95-2	Phenol		0.01	0.01			0.003					14.89	5.70	100.32	9.32	69.17	88.66			
7	Aldehydes & ketones	78-93-3	2-Butanone		0.003				0.02				0.86			54.27		4.50	15.16			
8		108-10-1	4-Methyl-2-pentanone																			
9		67-64-1	Acetone		0.01	0.06	0.01	0.02	0.01	0.04	0.01	0.06	0.14	3.75	30.54	12.12	8.37	14.14	13.79	44.61		
10		100-52-7	Benzaldehyde			0.08	0.96			0.41						6.56			5.50			
11		123-72-8	Butanal																			
12		112-31-2	Decanal				0.10															
13		111-71-7	Heptanal		0.02				0.07													
14		66-25-1	Hexanal		0.01				0.06							3.92	8.46					
15		124-19-6	Nonanal		0.05				0.02								5.64	8.38				
16		110-62-3	Pentanal						0.02													
17	Aromatic hydrocarbons	540-84-1	2,2,4-Trimethylpentane																			
18		108-08-7	2,4-Dimethylpentane										10.70									
19		124-18-5	Decane		0.02	0.01	0.03	0.01	0.02	0.05		0.56	0.11			11.55	5.12	6.64				
20		112-40-3	Dodecane		0.10	0.04	0.05	0.03	0.13	0.02		0.18	0.03		3.73	20.03	11.48	12.75				
21		142-82-5	Heptane								0.17			21.11								
22		544-76-3	Hexadecane				0.01	0.004	0.03			0.68							2028.40			
23		110-54-3	Hexane																			
24		111-84-2	Nonane		0.01	0.01	0.02	0.002		0.04		0.15	0.04	0.99		7.04	1.58		3.45			
25		111-65-9	Octane			0.004		0.01		0.00	0.02		0.24		26.60							
26		629-62-9	Pentadecane		1.71	0.02	0.02	0.02	0.06	0.01	0.01	9.96				4.94		6.41	3483.22			
27		629-59-4	Tetradecane				0.04	0.03	0.03	0.11	0.02	0.01	67.85		3.88	37.09	5.45	4.59	13.98			
28		629-50-5	Tridecane				0.04	0.04	0.03	0.13	0.01	0.002	1.96			10.78			6.46			
29		1120-21-4	Undecane		0.03	0.03	0.04	0.02	0.08	0.03	0.002	0.40	0.07		2.30	19.98	18.31	26.46	3.49	655.16		
30	Alkaloids	1121-55-7	3-ethenylpyridine *																			
31		54-11-5	Nicotine																			
32	Aromatic hydrocarbons	526-73-8	1,2,3-Trimethylbenzene				0.001	0.001		0.004				2.70		1.58	2.96	5.73	1.10			
33		95-93-2	1,2,4,5-Tetramethylbenzene				0.01		0.002						0.86	0.86	0.67	0.43	3.45	348.07		
34		95-63-6	1,2,4,5-Tetramethylbenzene			0.004								17.26	1.82	3.79	5.93	10.27	1.48			
35		95-47-6	1,2-dimethylbenzene		0.01	0.002	0.002			0.01				27.20	2.87	13.56	7.22	9.12	7.42			
36		108-38-3	1,3(4)-dimethylbenzene		0.04	0.004	0.004	0.003	0.001	0.03	0.001	0.01		122.08	6.70	29.61	21.23	27.90	21.11			
37		108-67-8	1,3,5-Trimethylbenzene				0.001		0.001					9.13	0.67	1.73	2.44	4.92	0.62			

Table A. 9 (continued)

#	Class	CAS#	Compound	No.	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
				Category	Candle								Mothball		Foam					
				Code	CND1	CND2	CND3	CND4	CND5	CND6	CND7	CND8	MB1	MB2	FOM1	FOM2	FOM3	FOM4	FOM5	FOM6
38	Aromatic hydrocarbons	611-14-3	2-Ethyltoluene		0.0004					0.002				0.95	0.67	1.25	2.20	4.06	0.53	
39		620-14-4	3-Ethyltoluene		0.001			0.001		0.002				5.20	1.20	3.35	5.31	10.70	1.24	
40		622-96-8	4-Ethyltoluene		0.0004			0.001		0.001				2.28	0.62	2.54	3.35	7.50	0.96	
41		71-43-2	Benzene		0.004	0.004	0.003	0.003	0.002	0.01	0.002	0.02		3.96			0.57	4.26	21.04	
42		100-41-4	Ethylbenzene		0.01	0.001	0.001	0.001	0.0003	0.01		0.003		18.36	5.07	21.32	7.13	7.45	5.07	
43		100-42-5	Styrene		0.005						0.003			4.71		4.12	5.93	2.20	1.34	
44		108-88-3	Toluene		0.01						0.07			102.25	13.26	33.40	12.53	7.50	3.54	
45	Esters	111-15-9	2-Ethoxyethyl acetate																	
46		123-86-4	Butyl acetate							0.07										
47		141-78-6	Ethyl acetate		0.01					0.02										
48		25265-77-4	Texanol **															132.93		
49		6846-50-0	TXIB ***														7.21	10013.67	336.93	
50	Glycol ethers	107-98-2	1-Methoxy-2-propanol																	
51		112-34-5	2-(2-Butoxyethoxy) ethanol																	
52		111-76-2	2-Butoxyethanol												19.74					
53		110-80-5	2-Ethoxyethanol																	
54		109-86-4	2-Methoxyethanol																	
55	Halo carbons	5131-66-8	Propylene glycol monobutyl ether																	
56		71-55-6	1,1,1-Trichloroethane																	
57		95-50-1	1,2-Dichlorobenzene				0.002	0.002	0.002					1.77		12.05				
58		107-06-2	1,2-Dichloroethane																	
59		78-87-5	1,2-Dichloropropane																	
60		106-46-7	1,4-Dichlorobenzene		0.14	0.10	0.11	0.21	0.30	0.25	0.15		3.03	0.14	366.23	1761.31	1544.95	70.22	2593.13	
61		75-27-4	Bromodichloromethane																	
62		56-23-5	Carbon tetrachloride																	
63		67-66-3	Chloroform																	
64		124-48-1	Dibromochloromethane																	
65		75-09-2	Dichloromethane																	
66		79-34-5	1,1,2,2-Tetrachloroethane																	
67		127-18-4	Tetrachloroethylene																	
68		79-01-6	Trichloroethylene																	
69	Terpenes	80-56-8	α -Pinene		3.65	0.34	0.05	0.36	0.06	0.03	0.05			2.25	4.94	6.93	41.18		159.33	
70		127-91-3	β -Pinene		0.16	0.07	0.01	0.01		0.004					1.87	2.34	7.21			
71		79-92-5	Camphene		0.52	0.02	0.003	0.01		0.004	0.01									
72		138-86-3	Limonene		11.87	4.11	0.11	0.34	0.02	0.06	0.01	0.03			11.36	17.02	26.08	9.14		

Note: * 3-ethenylpyridine is calibrated against 4-ethenylpyridine (100-43-6), ** Texanol (2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate)

*** TXIB (2,2,4-Trimethyl-1,3-pentanediol diisobutyrate)

The level below MDL is highlighted in blue.

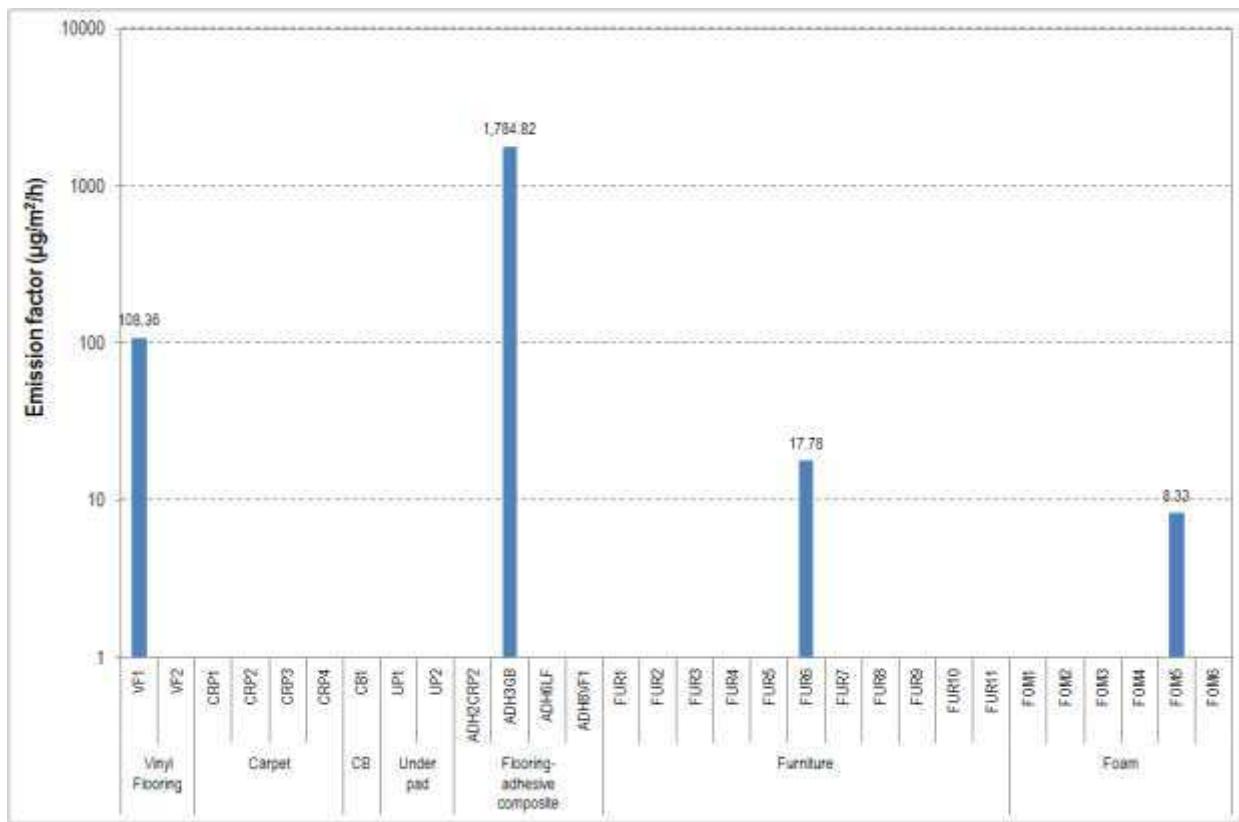


Figure A. 1: Emission factors for solid building materials and furnishings (#1: 1-butanol)

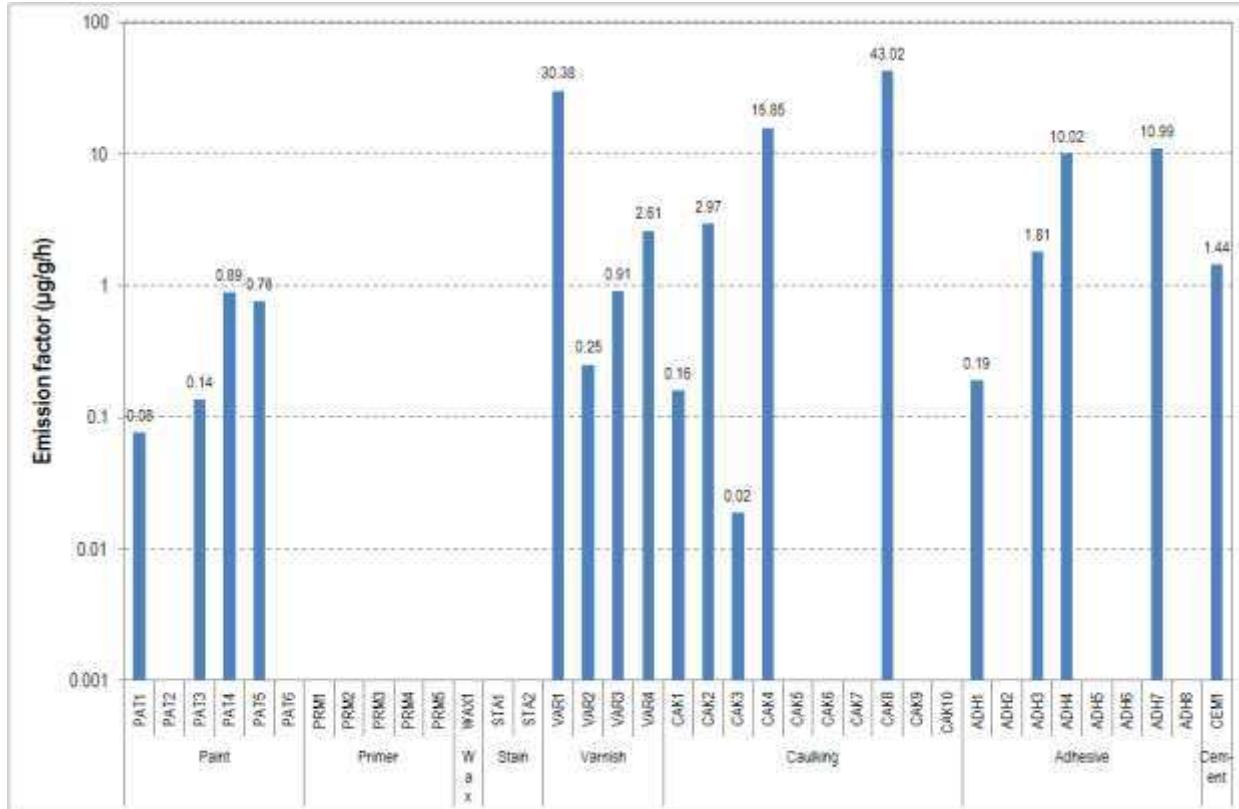


Figure A. 2: Emission factors for liquid building materials (#1: 1-butanol)

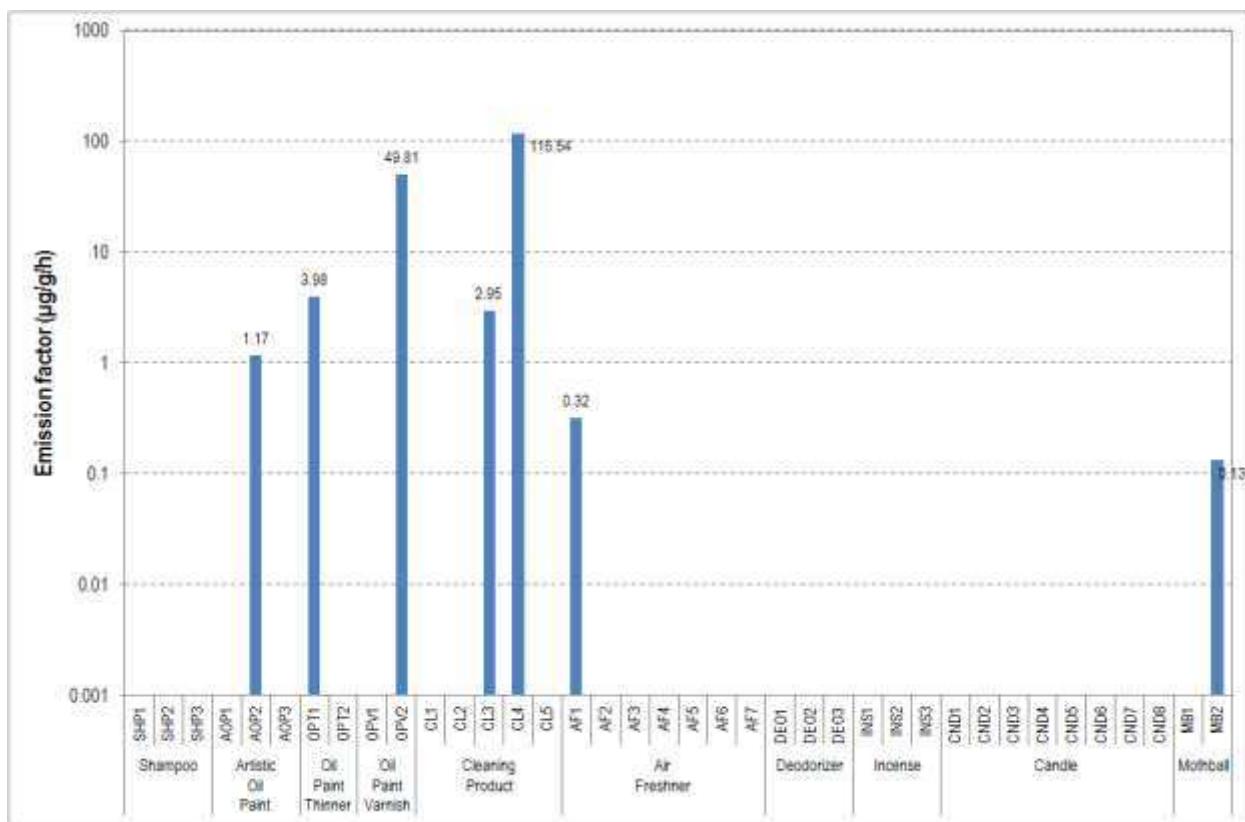


Figure A. 3: Emission factors for consumer/personal-care products (#1: 1-butanol)

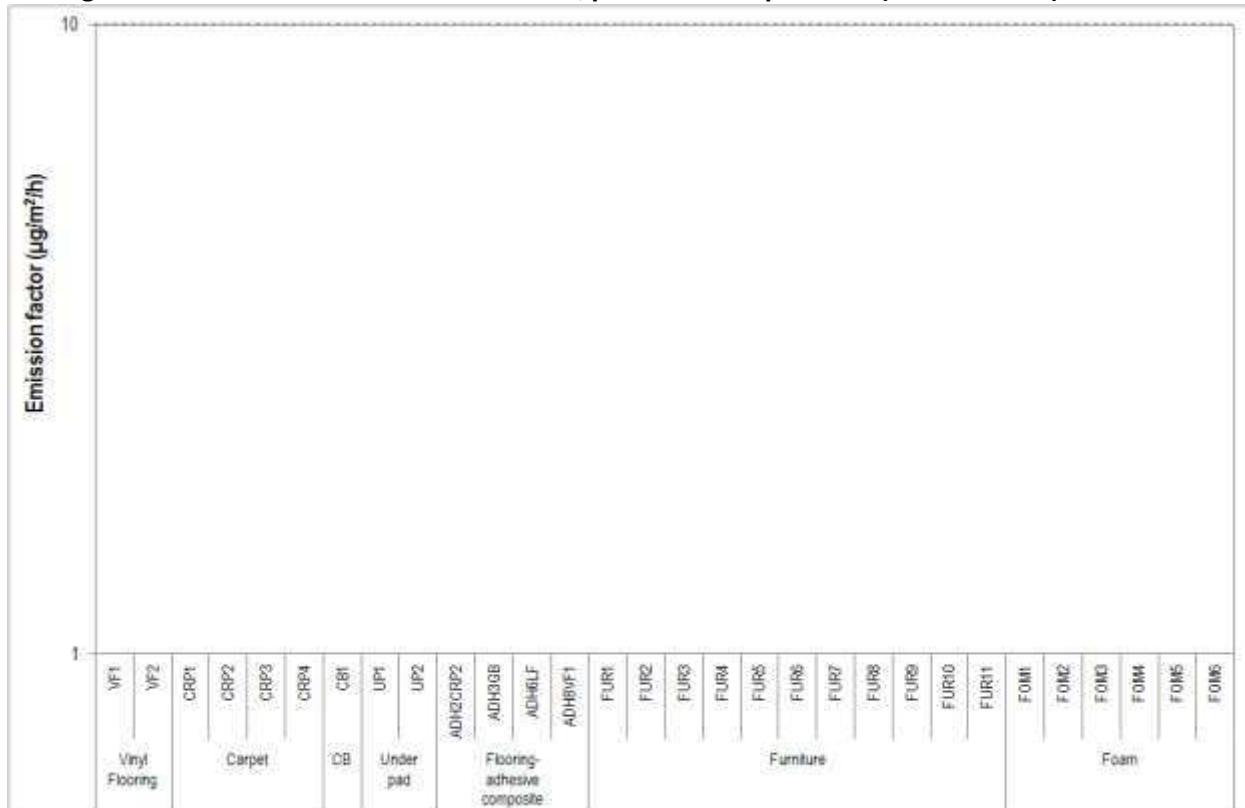


Figure A. 4: Emission factors for solid building materials and furnishings (#2: 1-propanol)

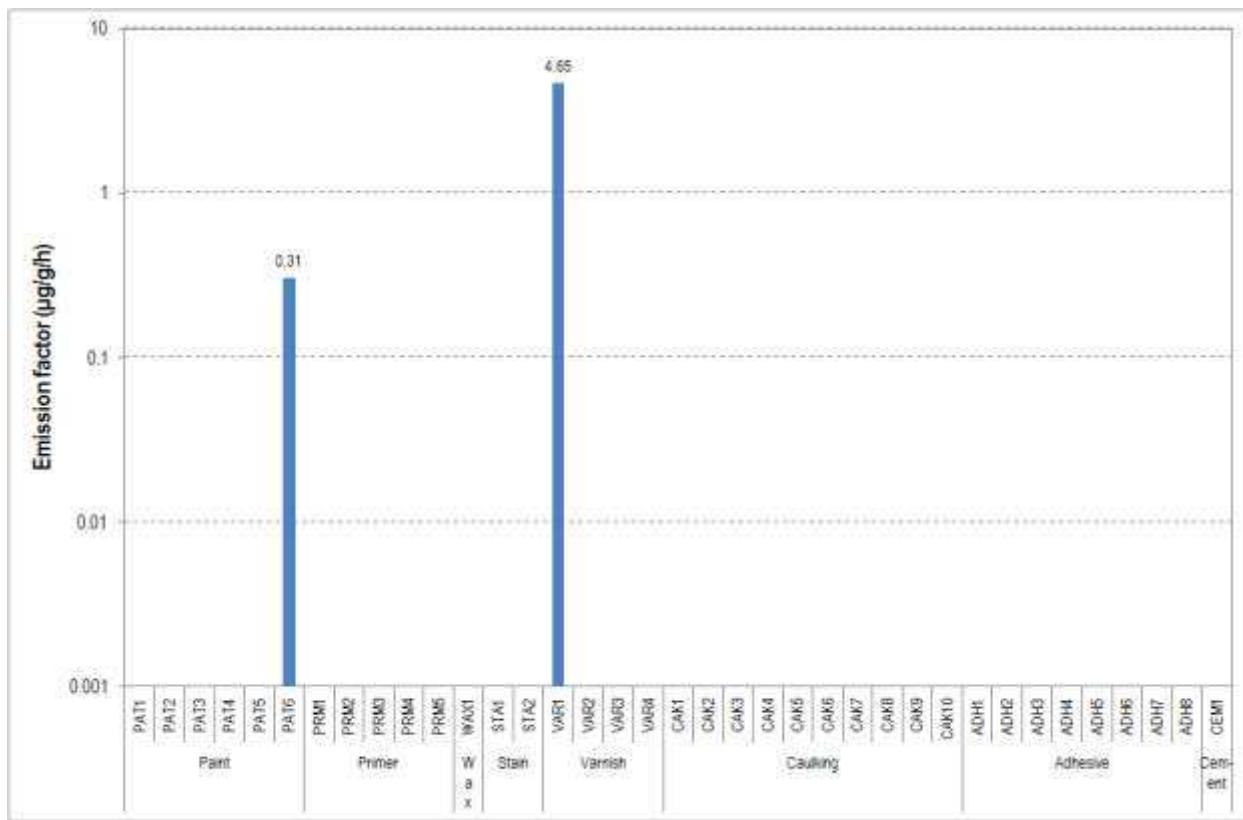


Figure A. 5: Emission factors for liquid building materials (#2: 1-propanol)

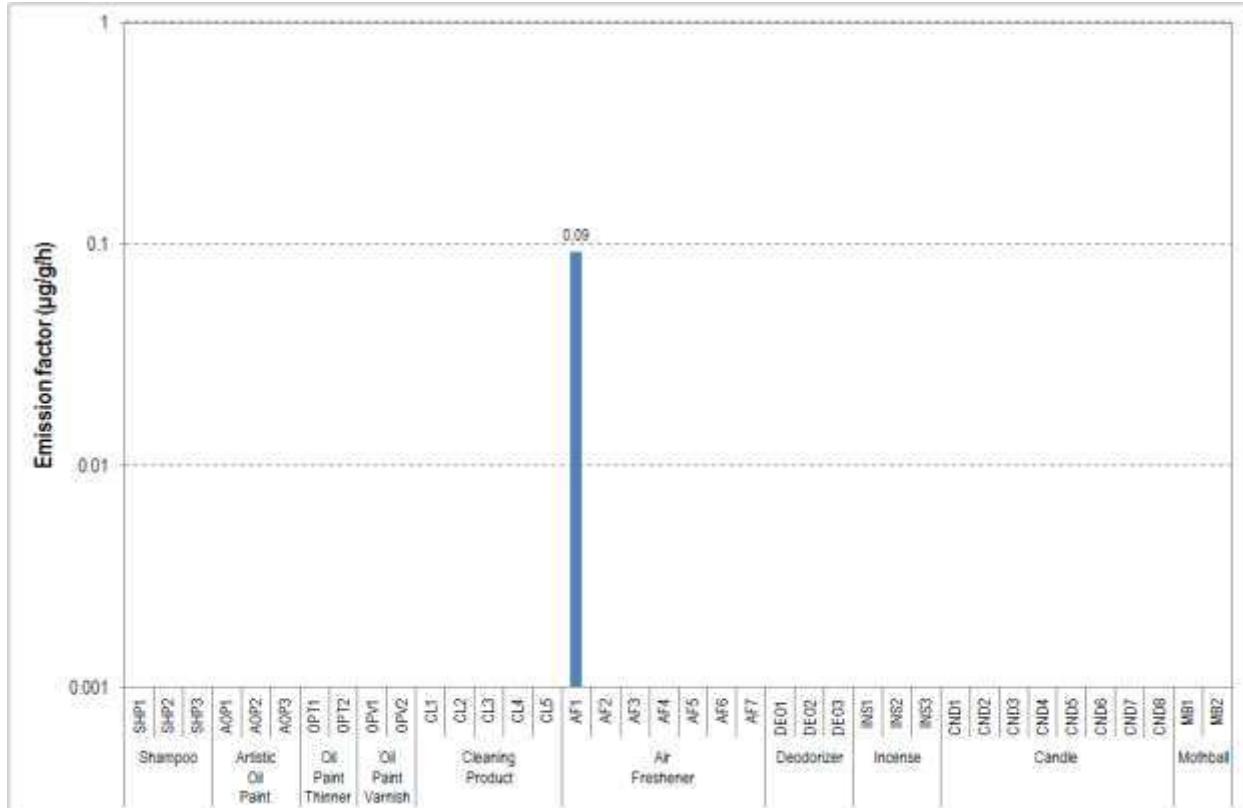


Figure A. 6: Emission factors for consumer/personal-care products (#2: 1-propanol)

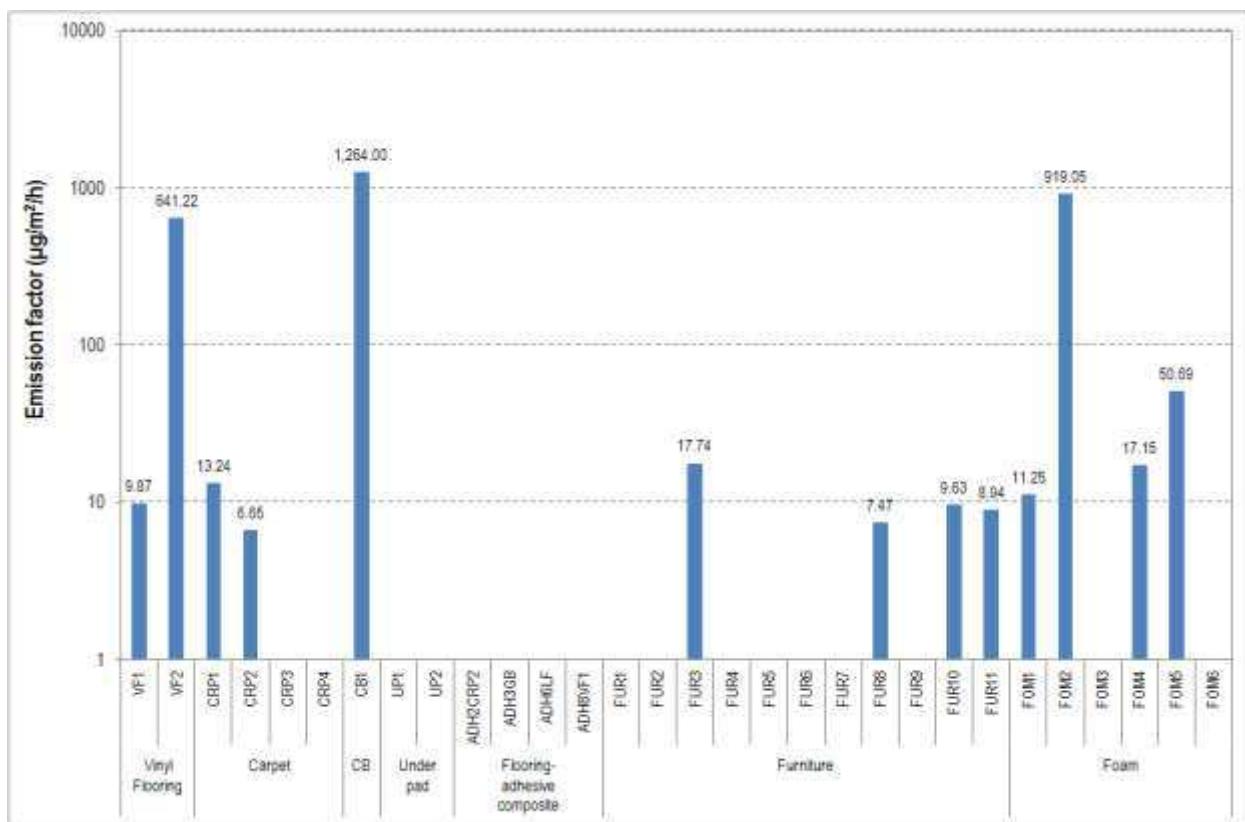


Figure A. 7: Emission factors for solid building materials and furnishings (#3: 2-ethyl-1-hexanol)

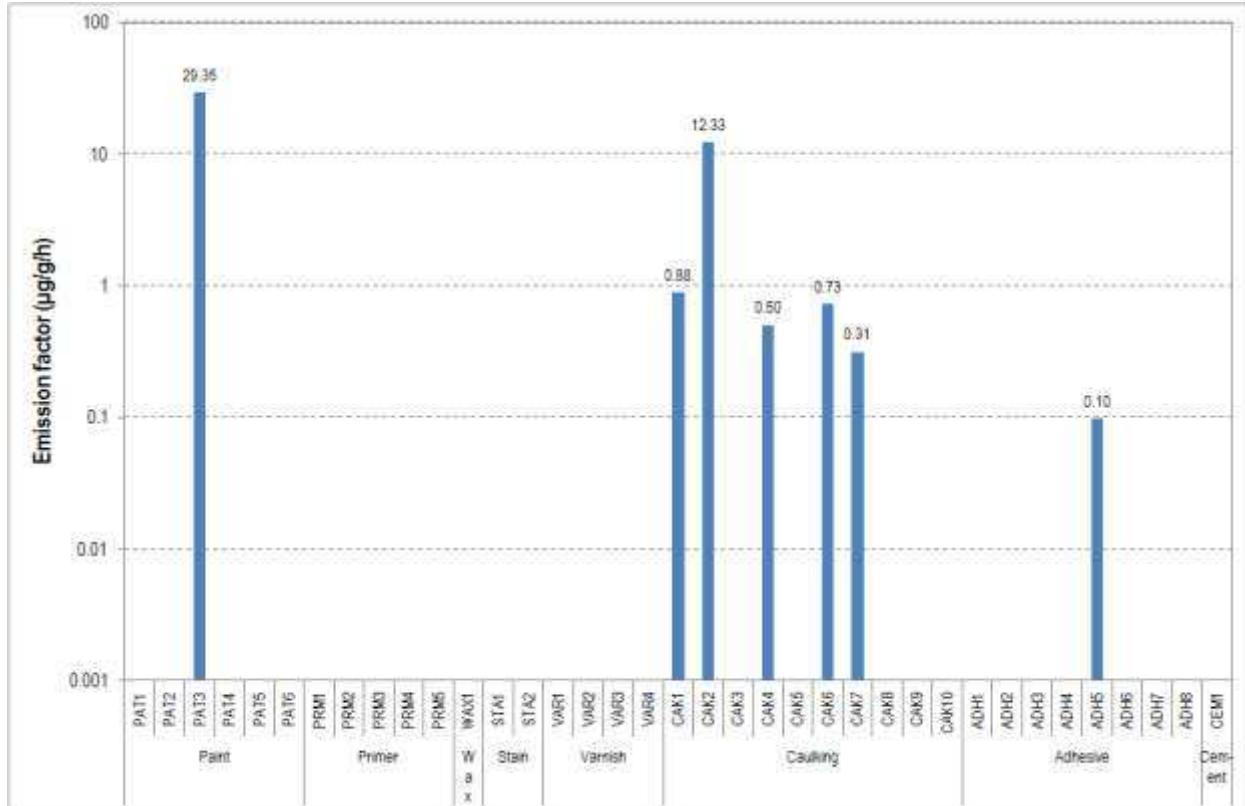


Figure A. 8: Emission factors for liquid building materials (#3: 2-ethyl-1-hexanol)

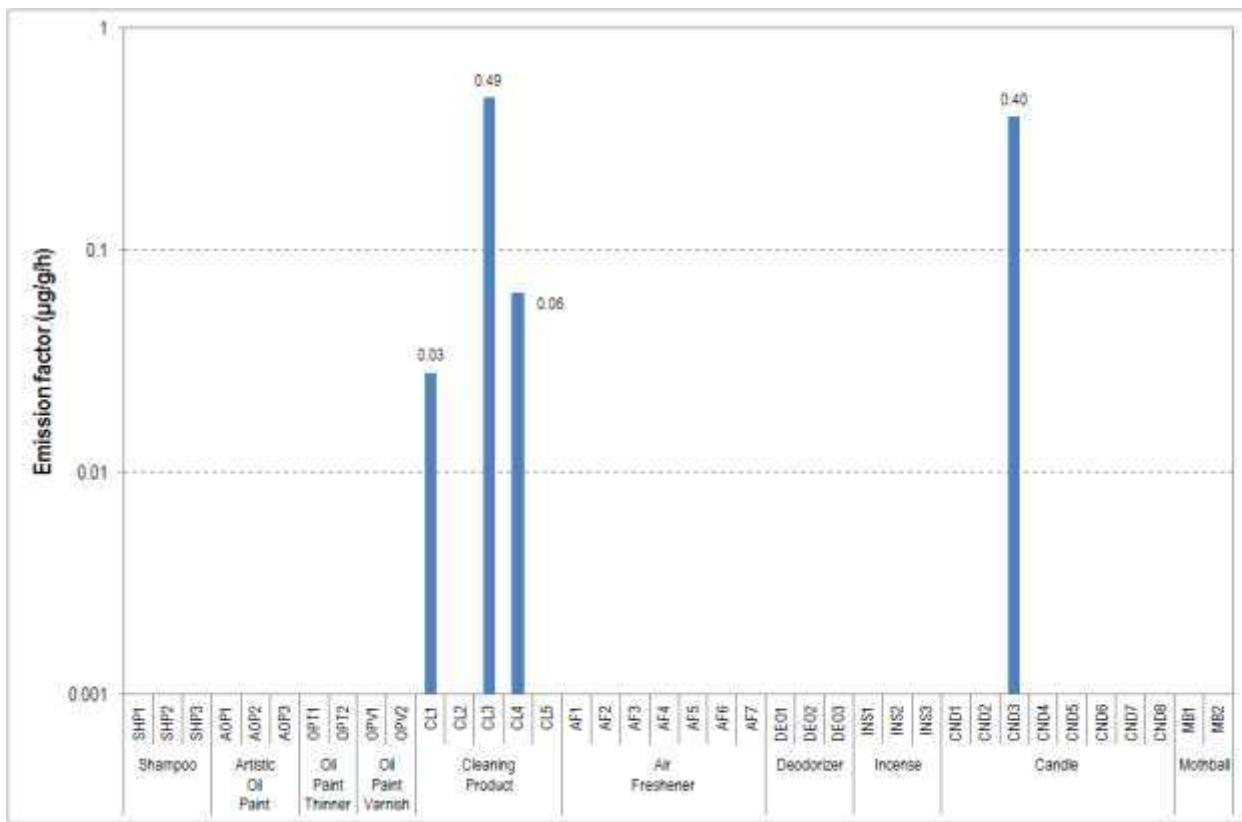


Figure A. 9: Emission factors for consumer/personal-care products (#3: 2-ethyl-1-hexanol)

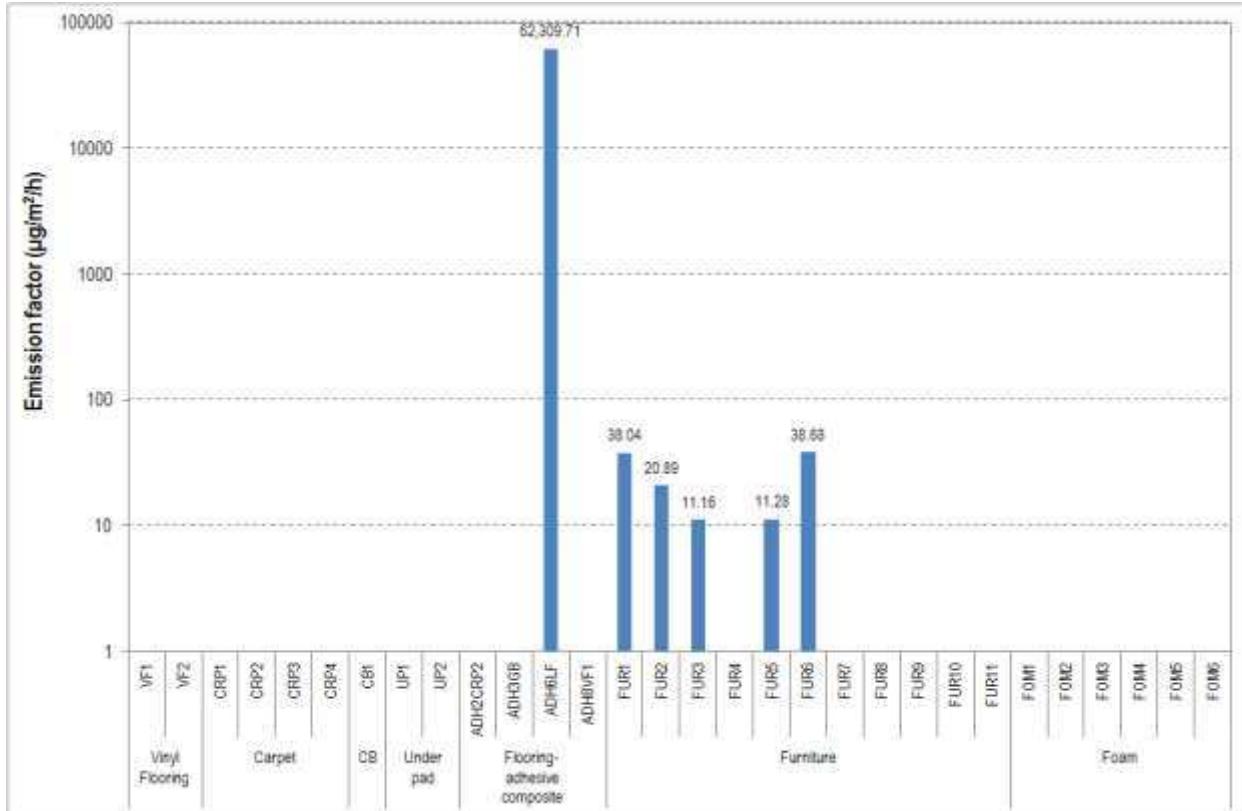


Figure A. 10: Emission factors for solid building materials and furnishings (#4: 2-propanol)

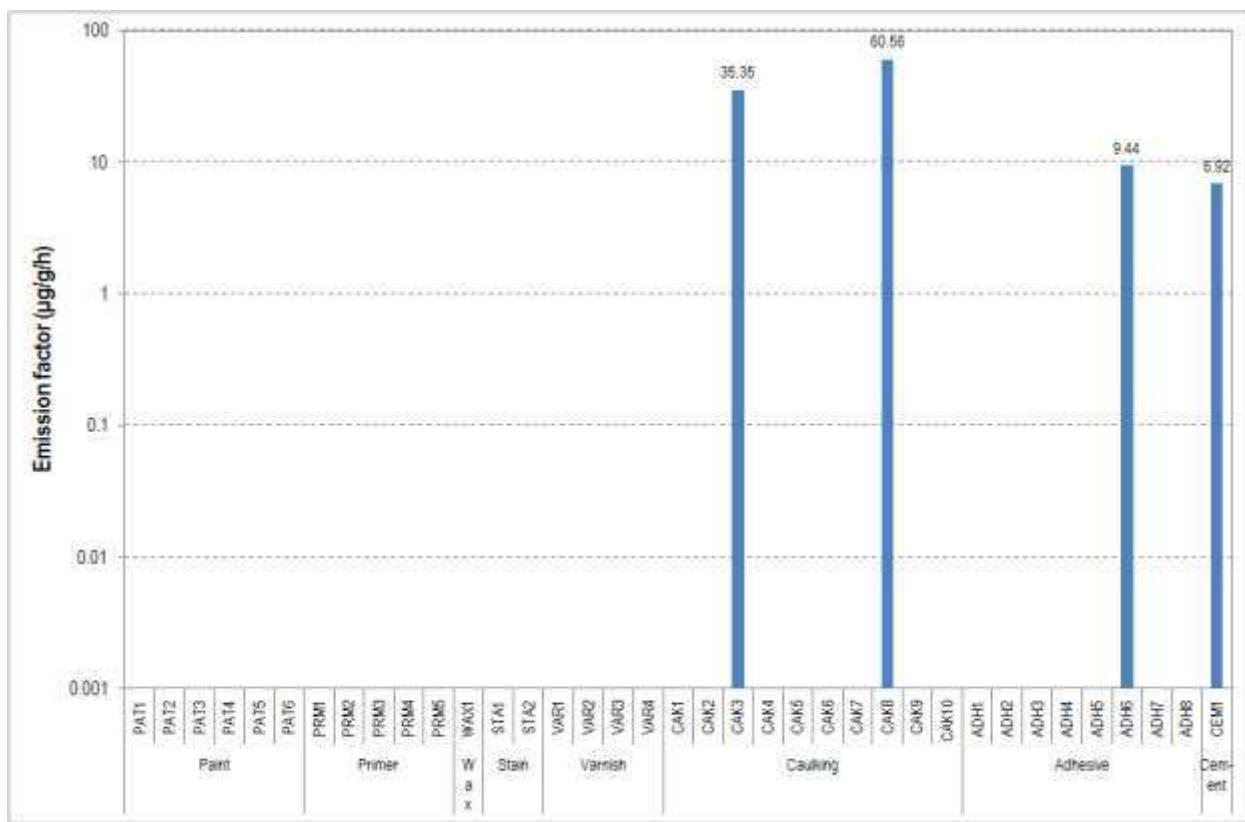


Figure A. 11: Emission factors for liquid building materials (#4: 2-propanol)

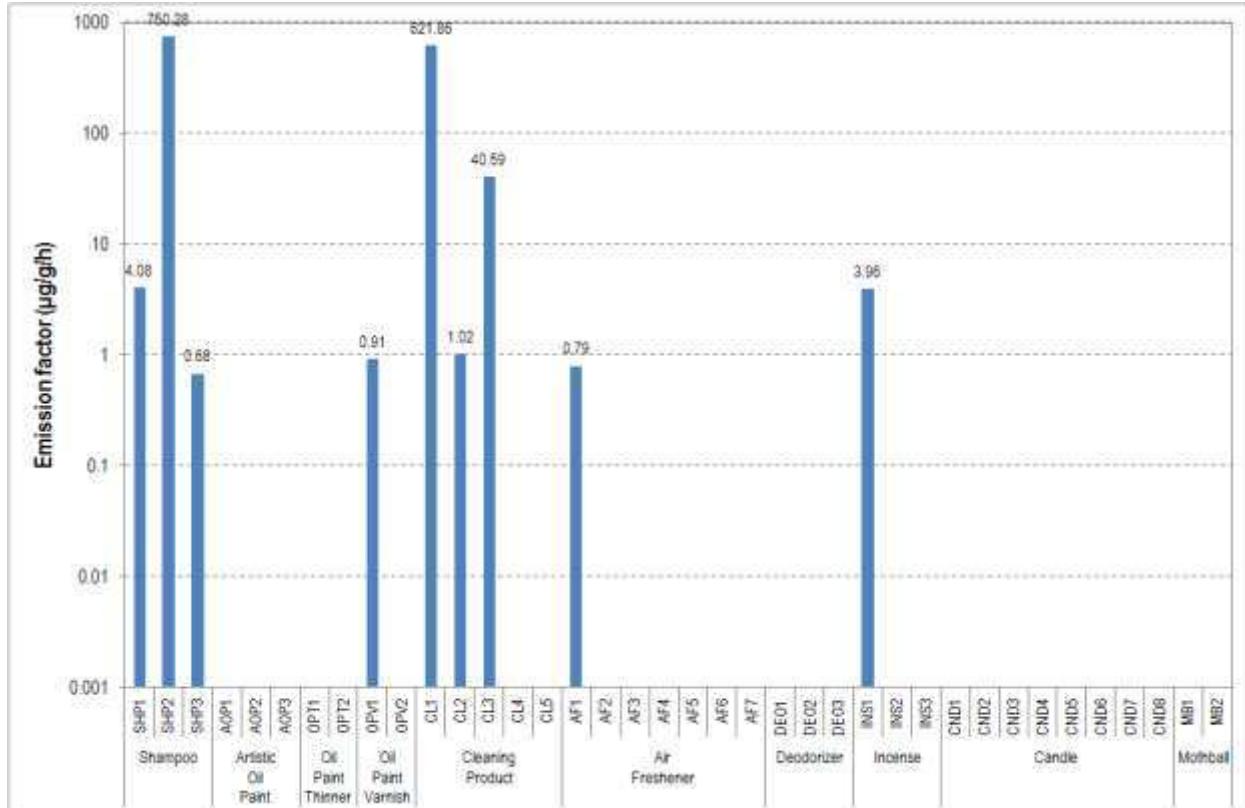


Figure A. 12: Emission factors for consumer/personal-care products (#4: 2-propanol)

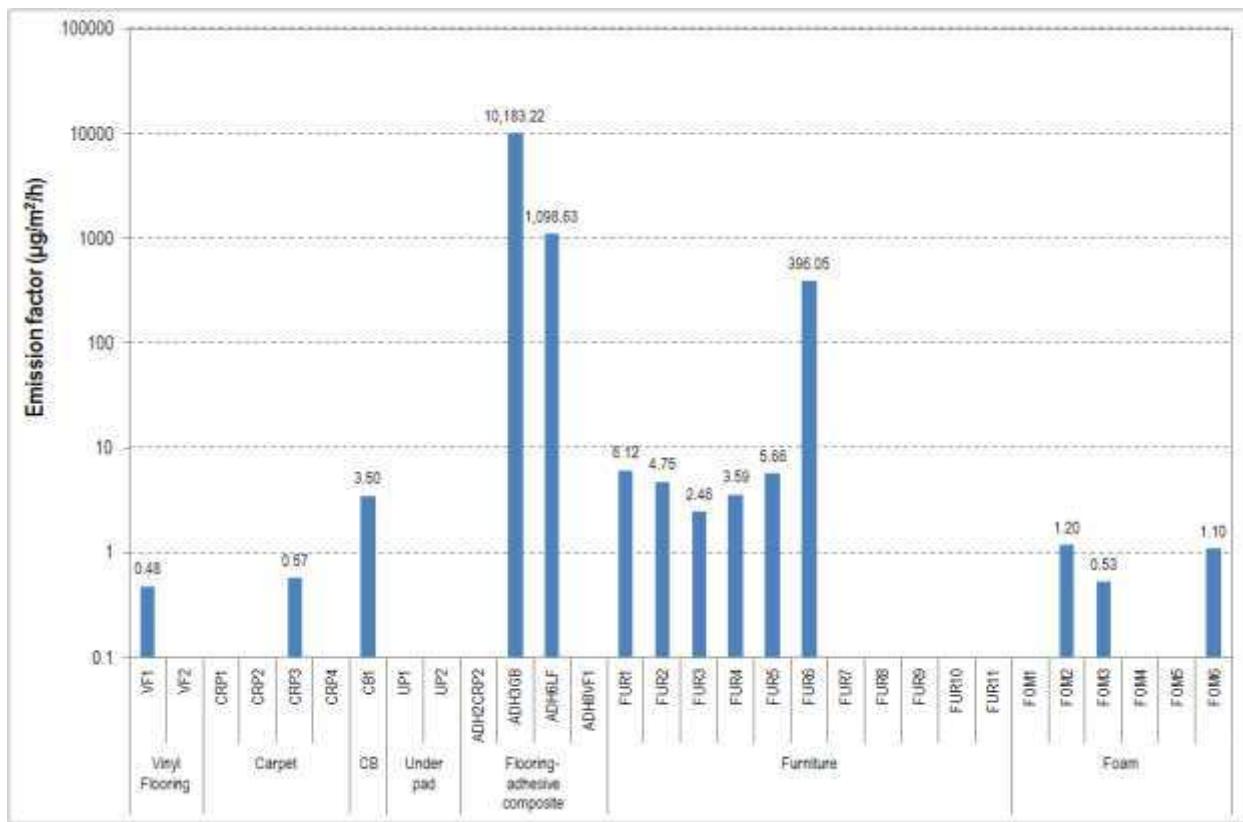


Figure A. 13: Emission factors for solid building materials and furnishings (#5: ethanol)

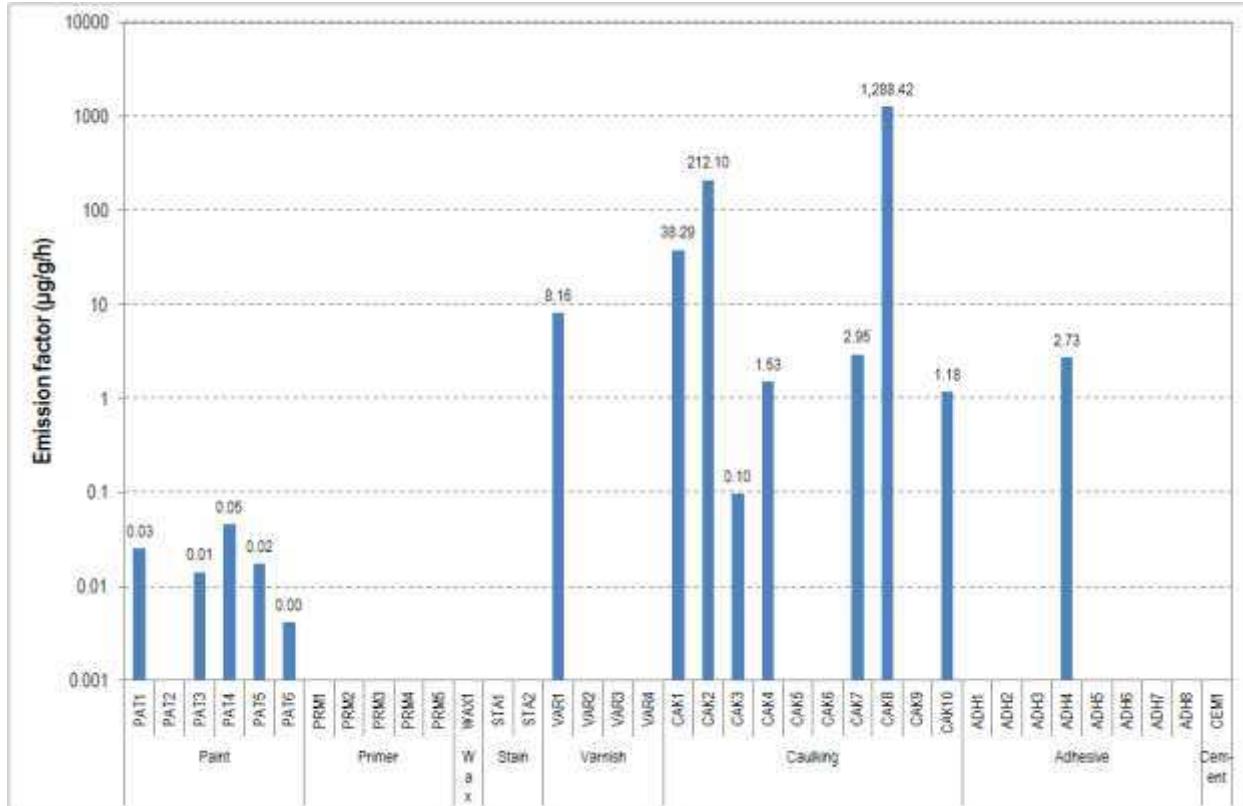


Figure A. 14: Emission factors for liquid building materials (#5: ethanol)

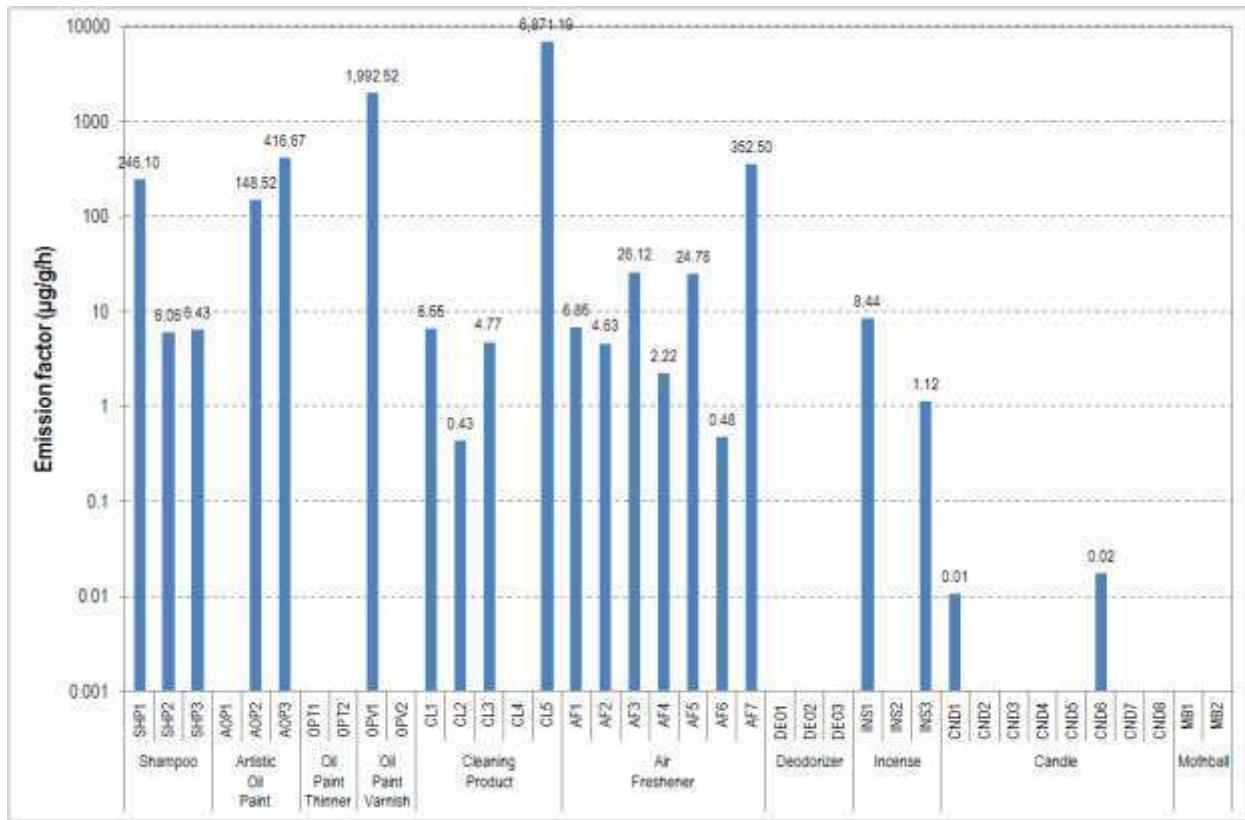


Figure A. 15: Emission factors for consumer/personal-care products (#5: ethanol)

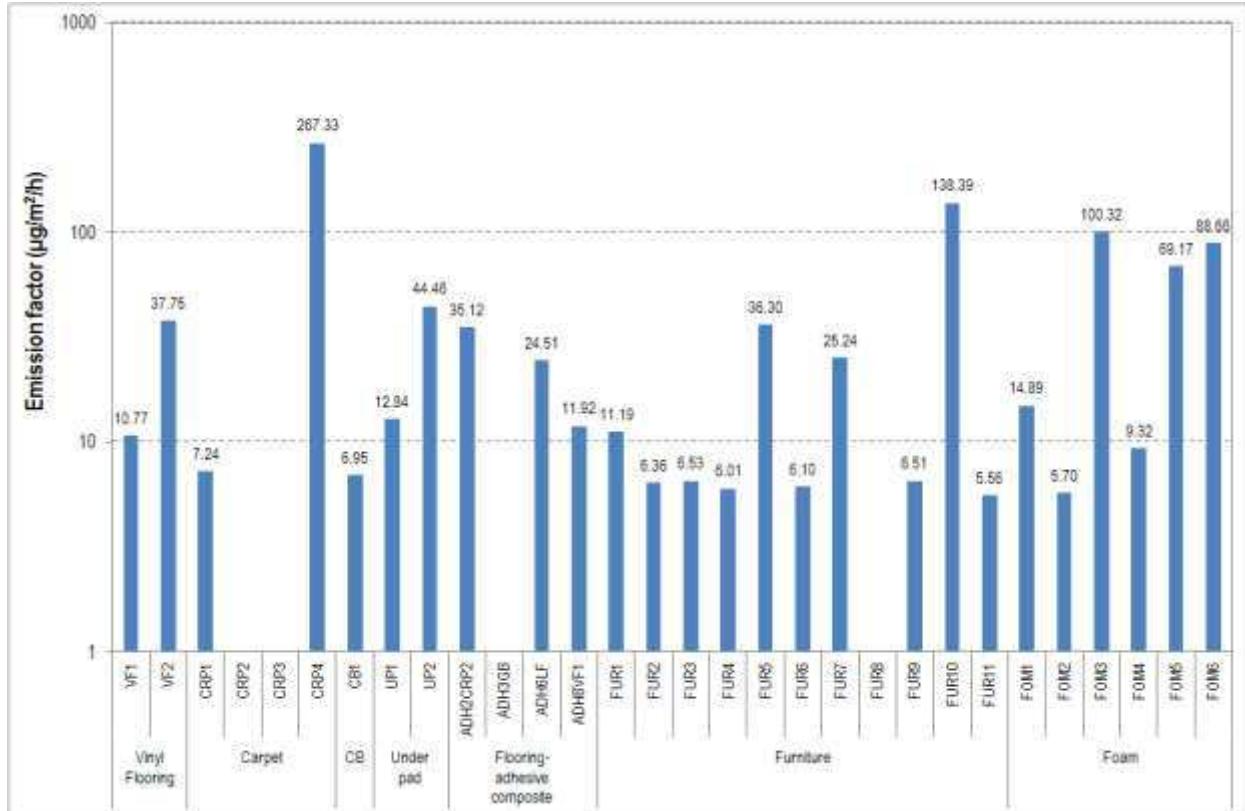


Figure A. 16: Emission factors for solid building materials and furnishings (#6: phenol)

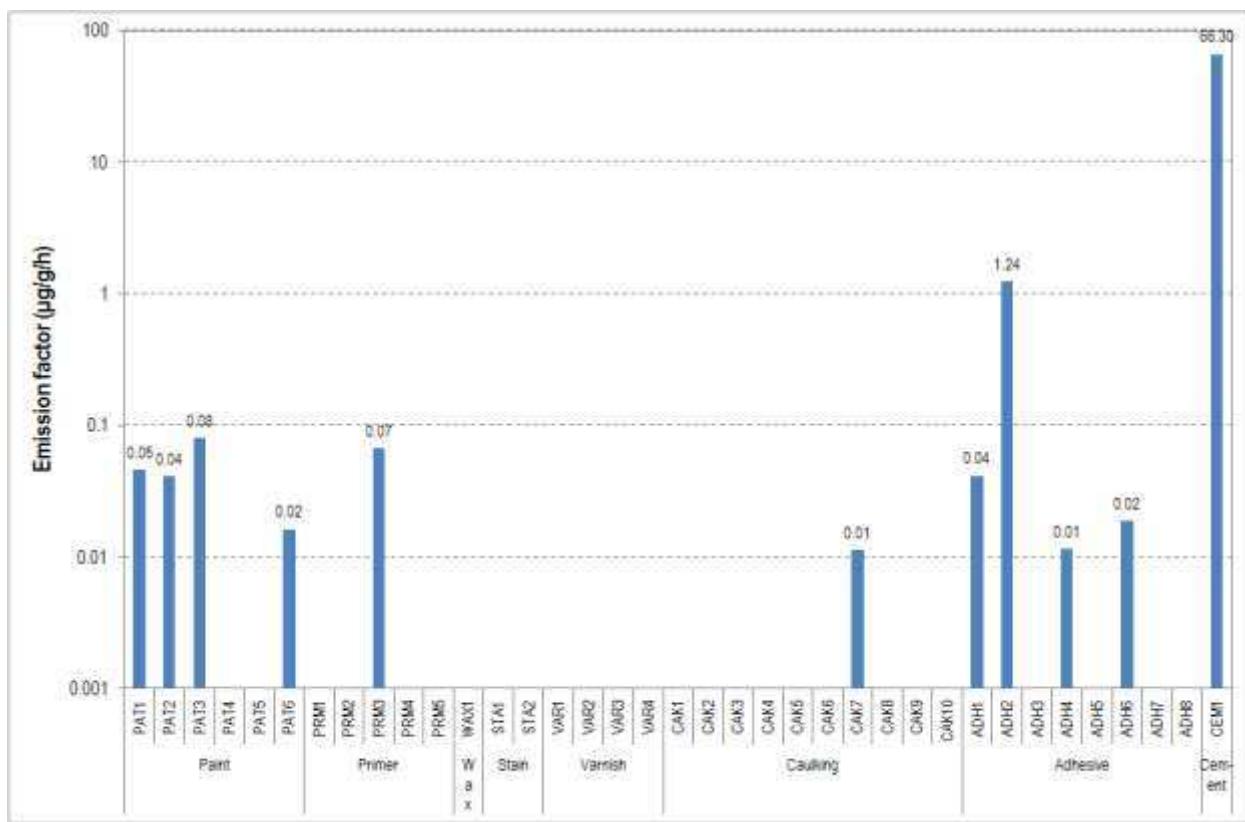


Figure A. 17: Emission factors for liquid building materials (#6: phenol)

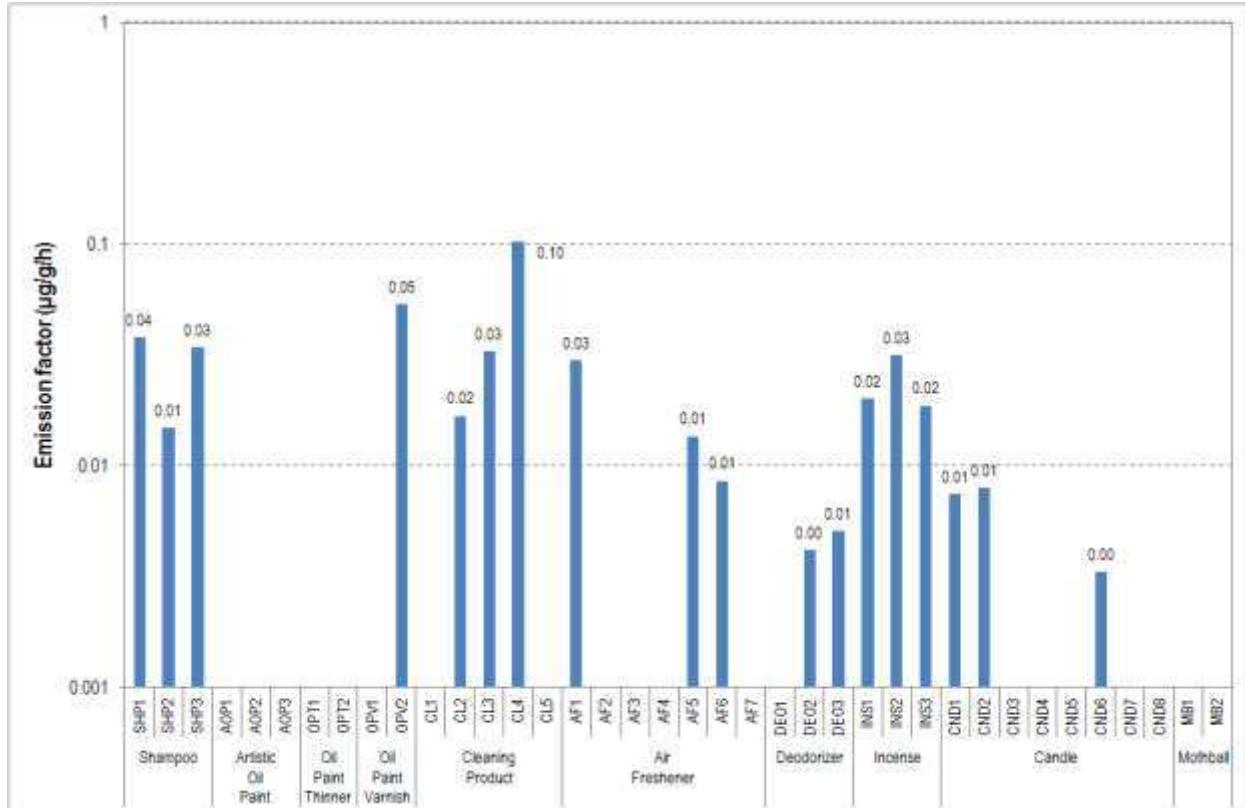


Figure A. 18: Emission factors for consumer/personal-care products (#6: phenol)

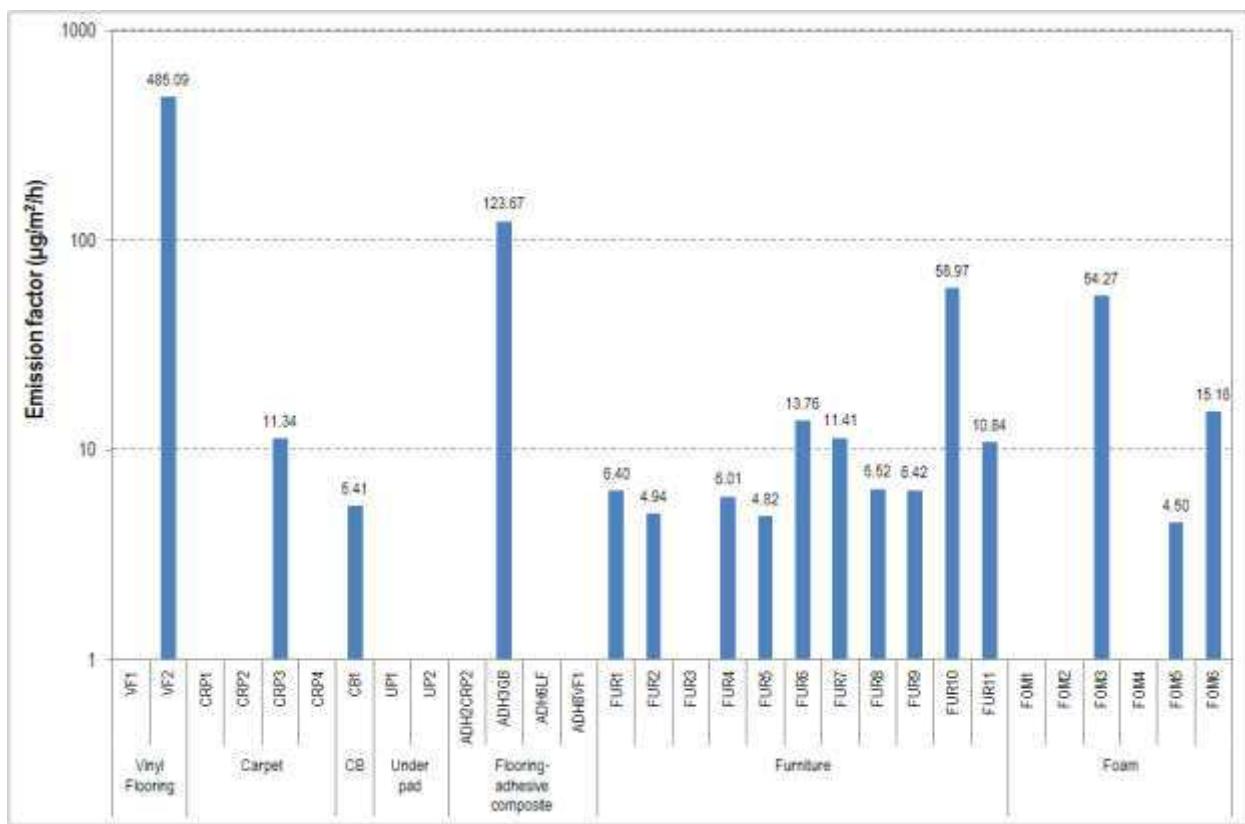


Figure A. 19: Emission factors for solid building materials and furnishings (#7: 2-butanone)

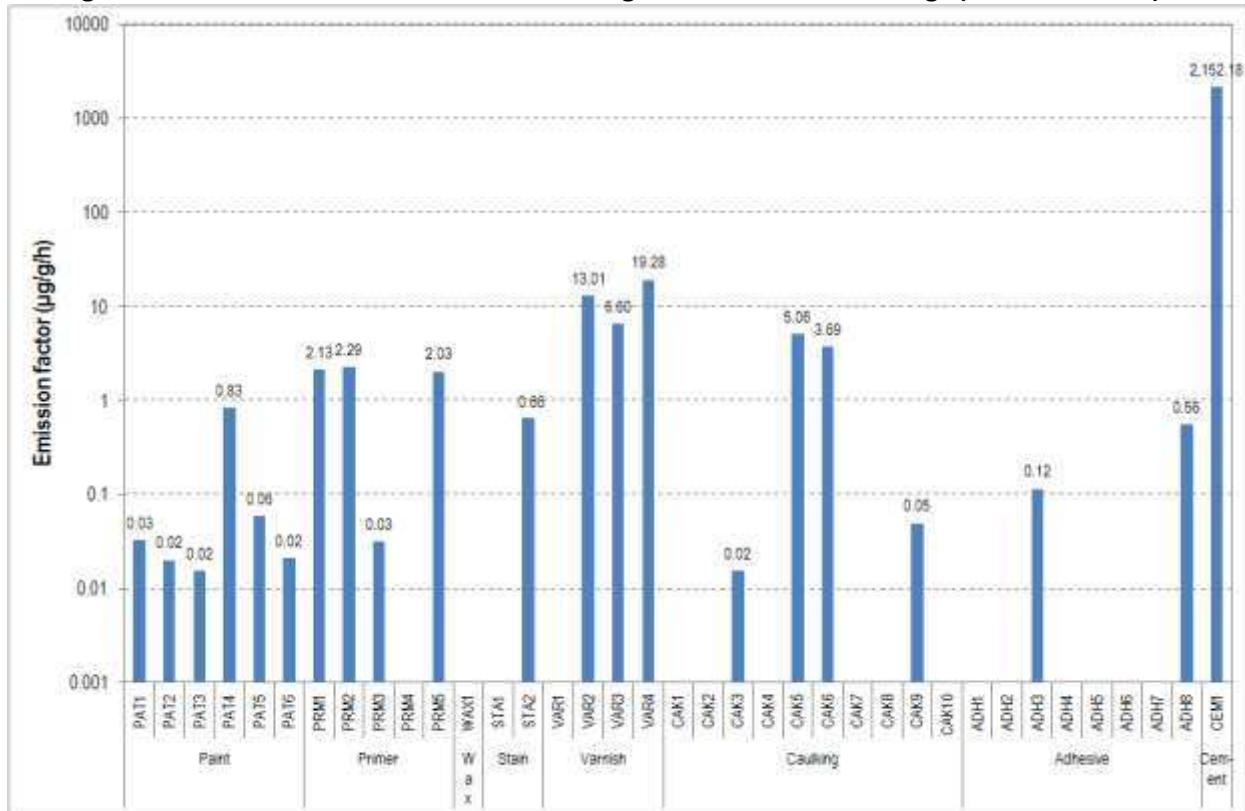


Figure A. 20: Emission factors for liquid building materials (#7: 2-butanone)

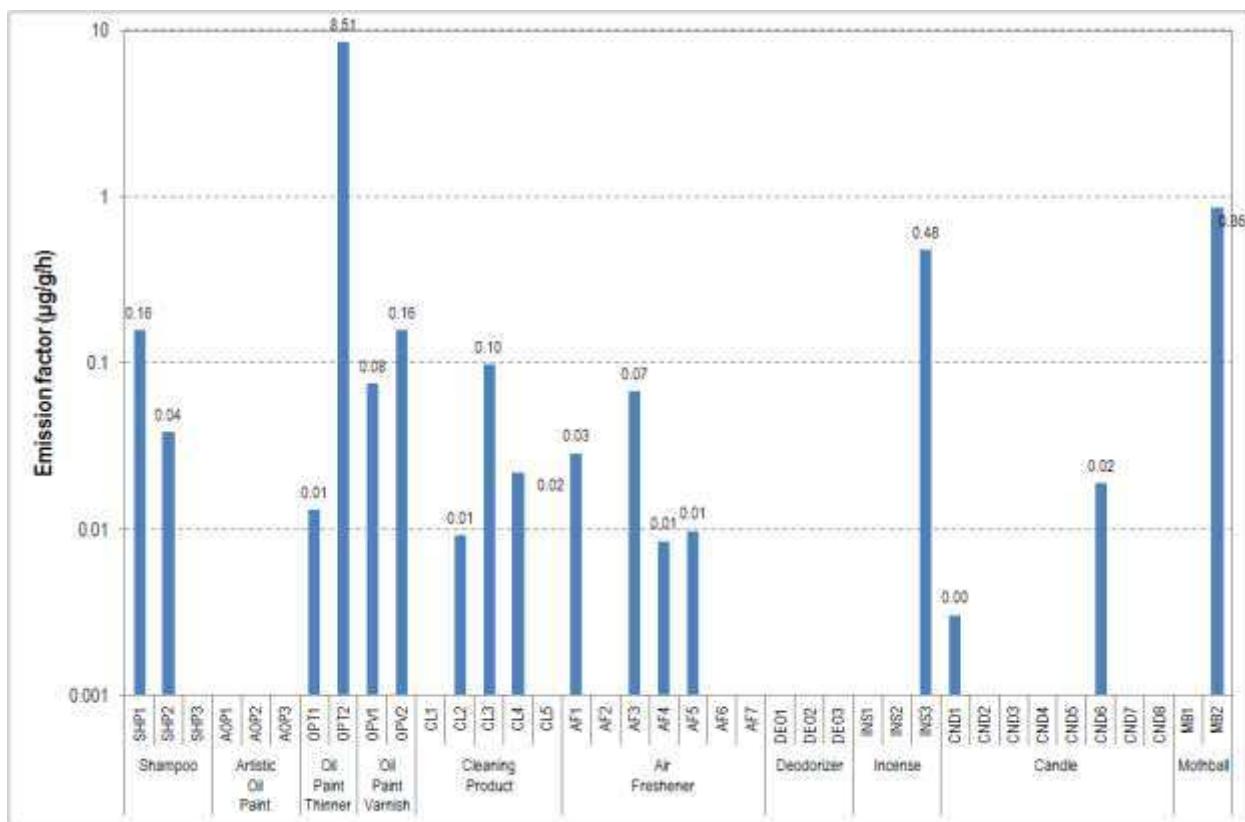


Figure A. 21: Emission factors for consumer/personal-care products (#7: 2-butanone)

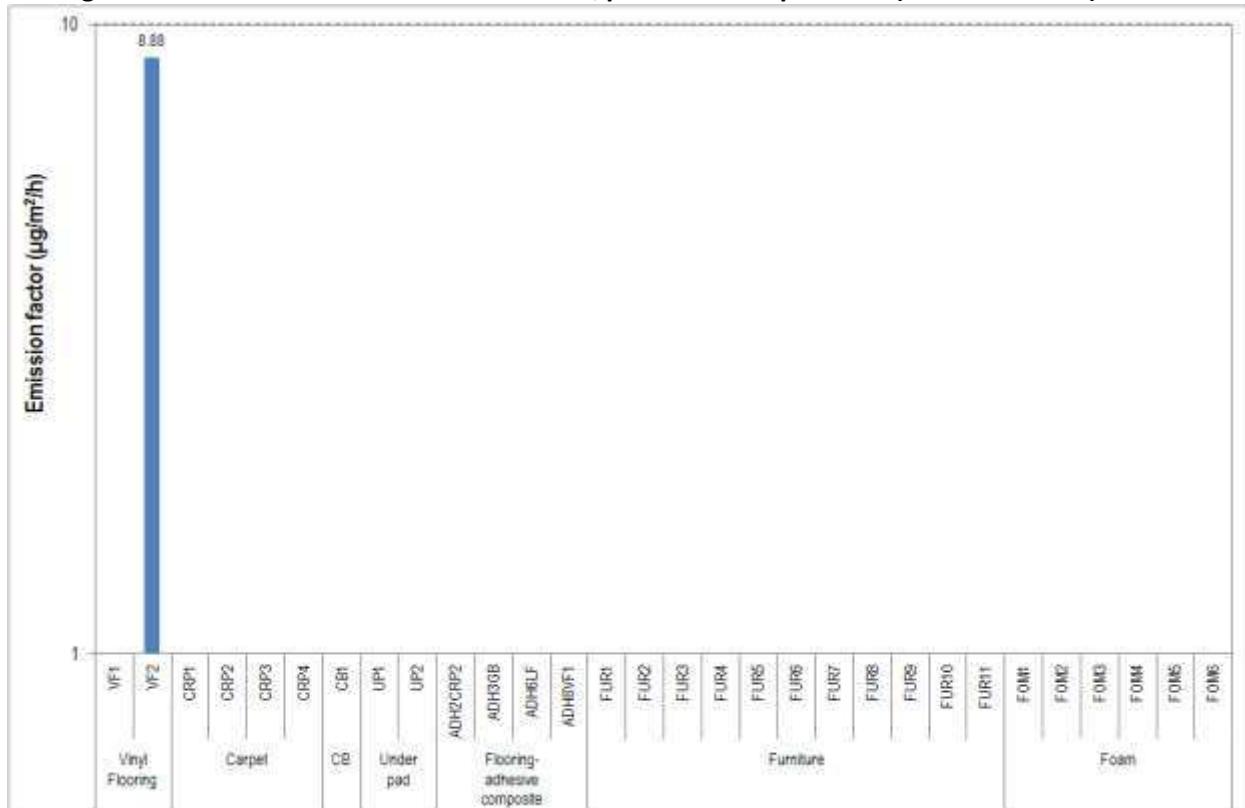


Figure A. 22: Emission factors for solid building materials and furnishings (#8: 4-methyl-2-pentanone)

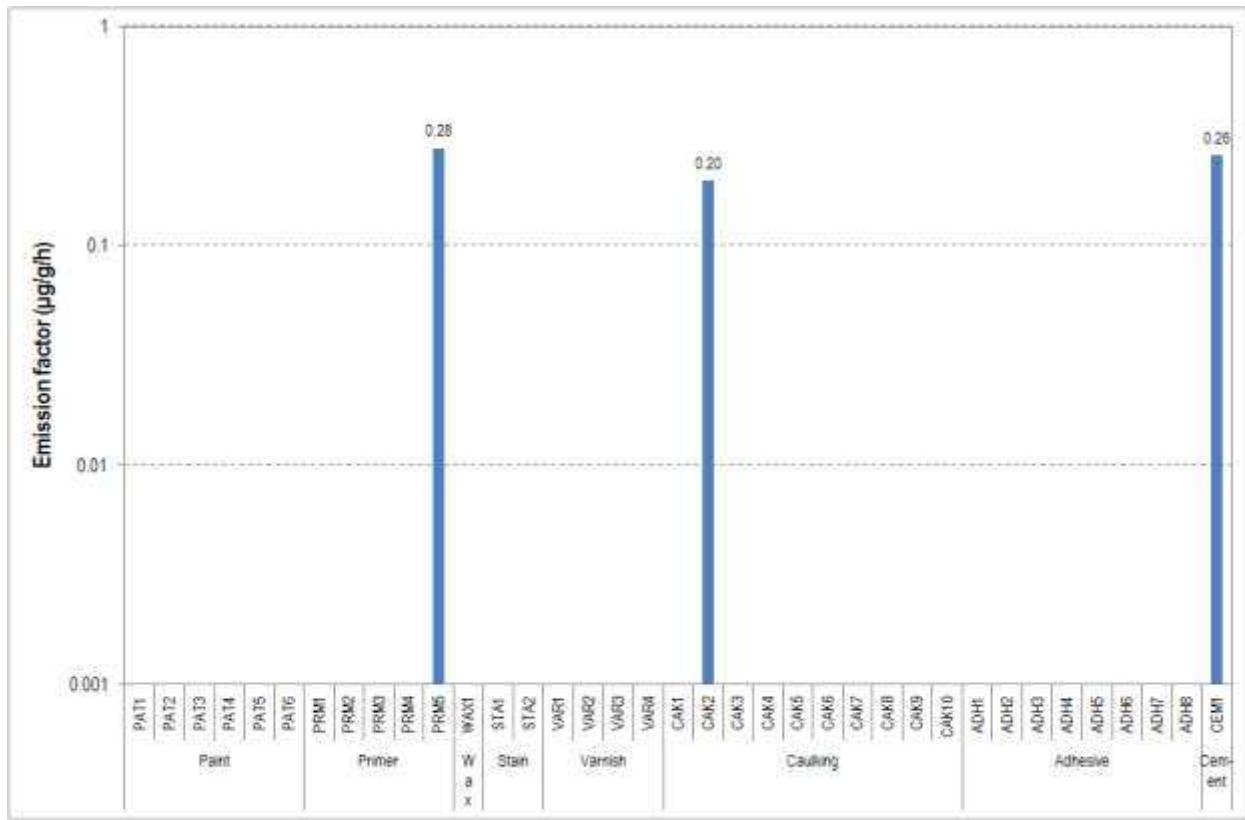


Figure A. 23: Emission factors for liquid building materials (#8: 4-methyl-2-pentanone)

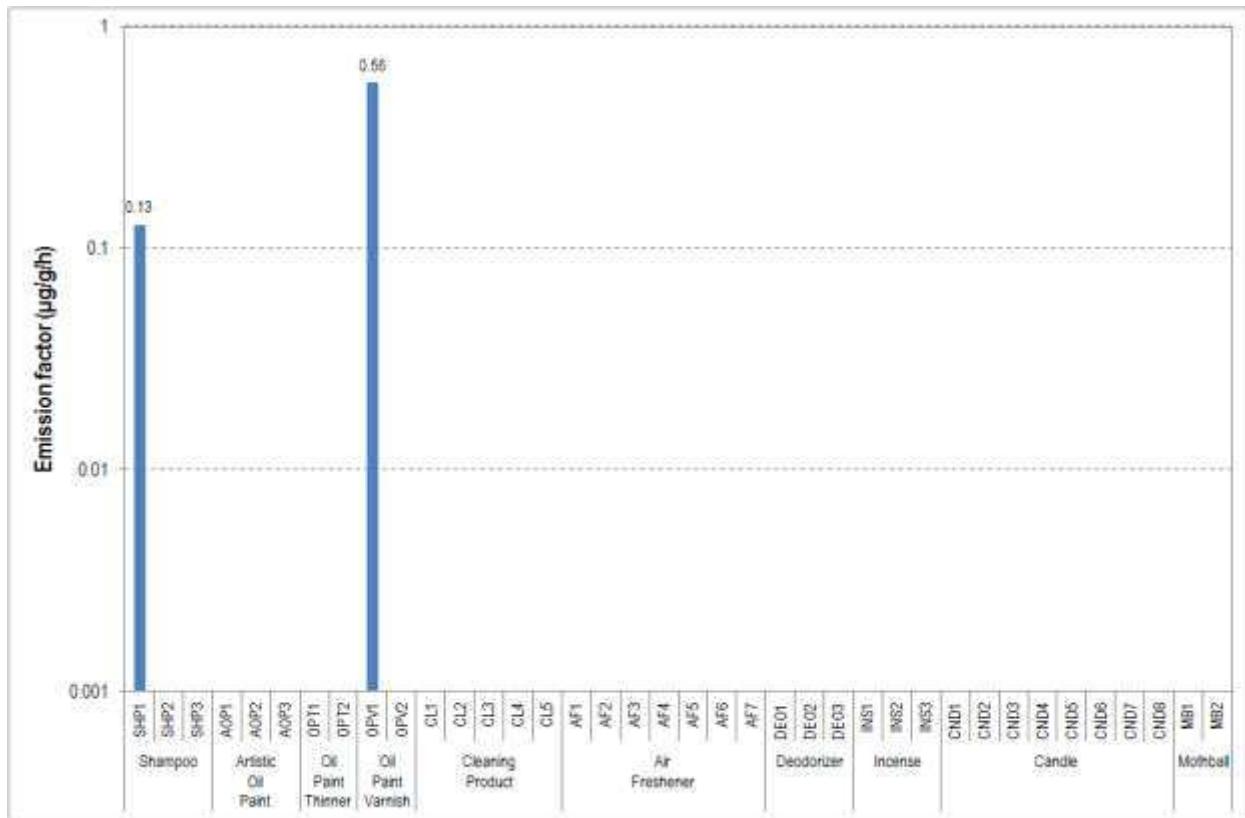


Figure A. 24: Emission factors for consumer/personal-care products (#8: 4-methyl-2-pentanone)

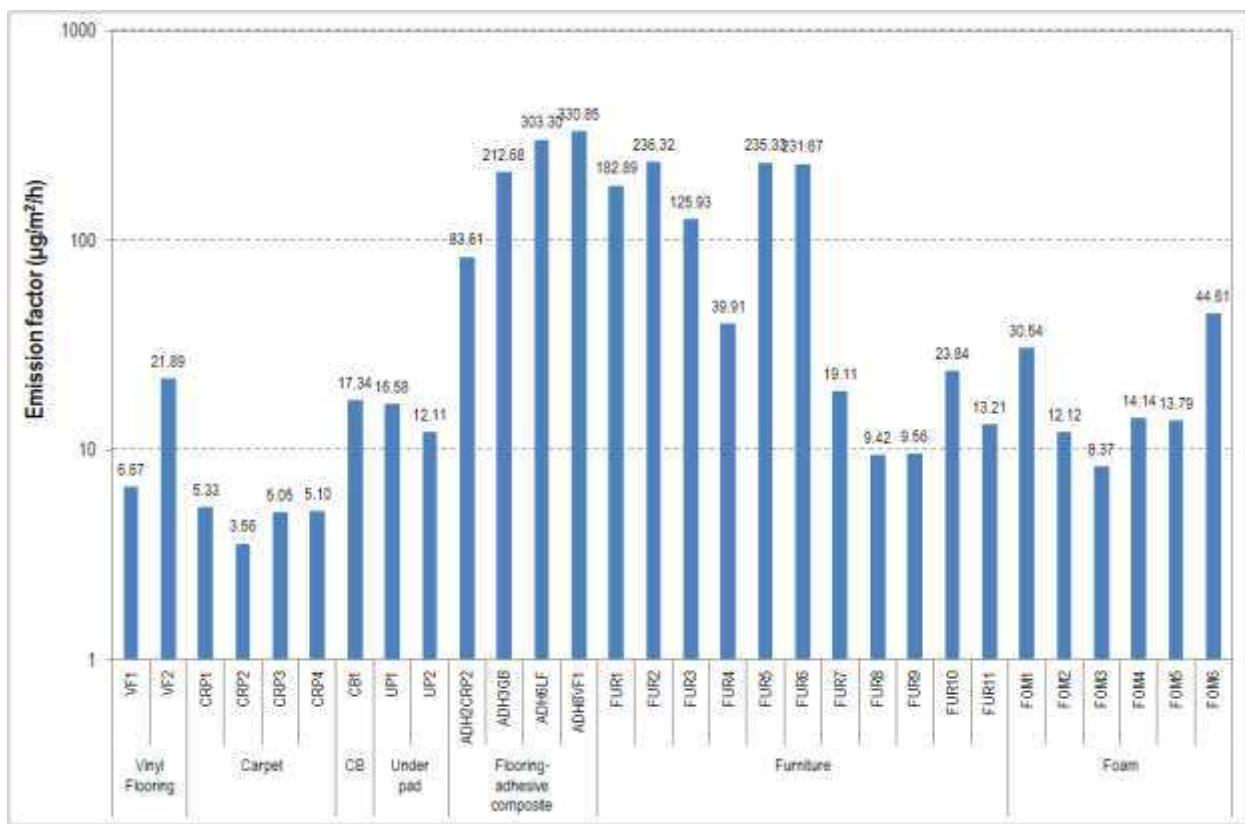


Figure A. 25: Emission factors for solid building materials and furnishings (#9: acetone)

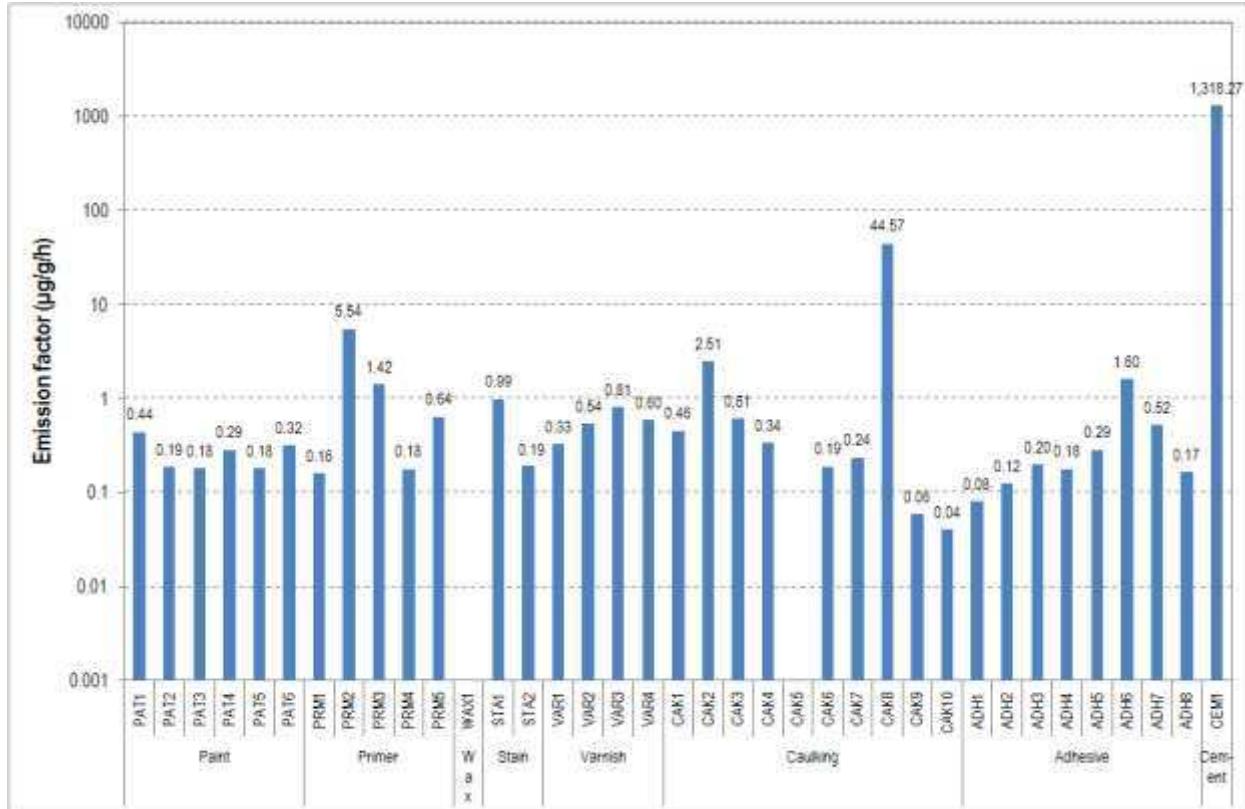


Figure A. 26: Emission factors for liquid building materials (#9: acetone)

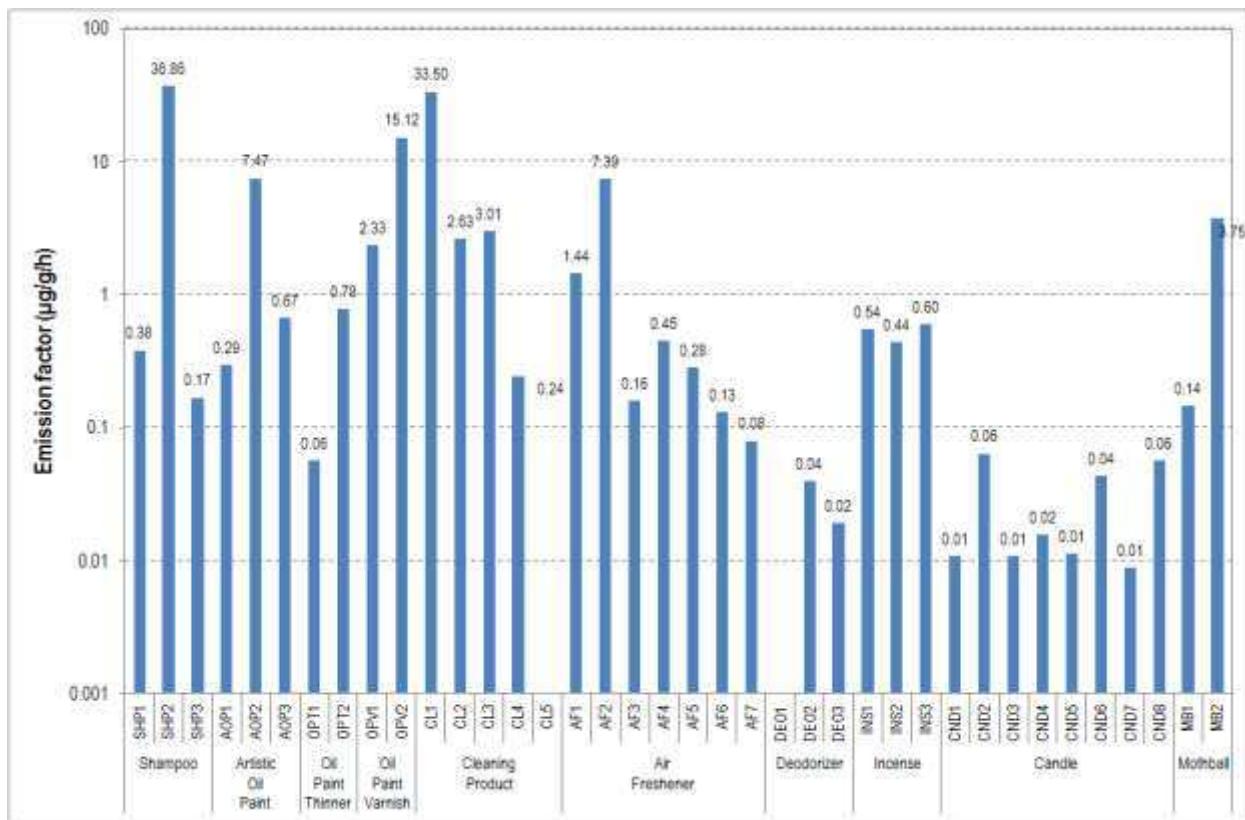


Figure A. 27: Emission factors for consumer/personal-care products (#9: acetone)

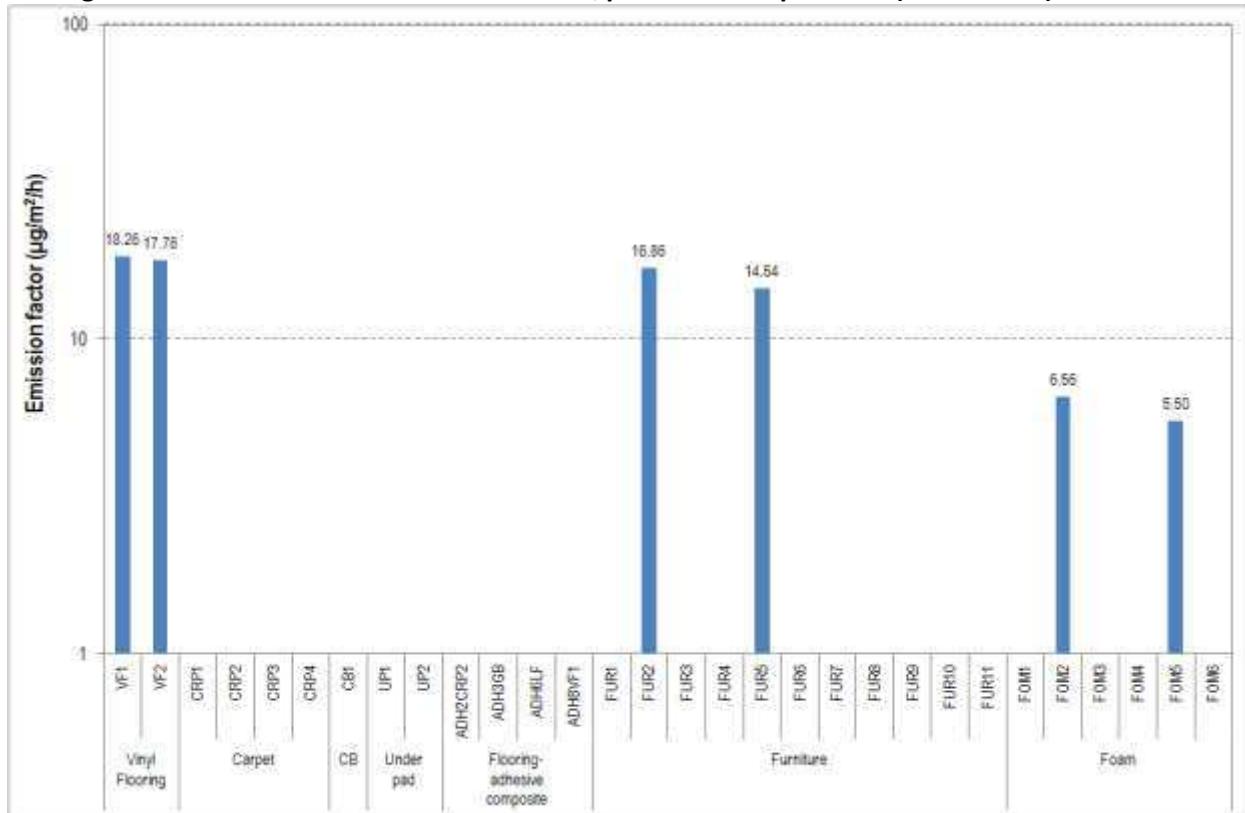


Figure A. 28: Emission factors for solid building materials and furnishings (#10: benzaldehyde)

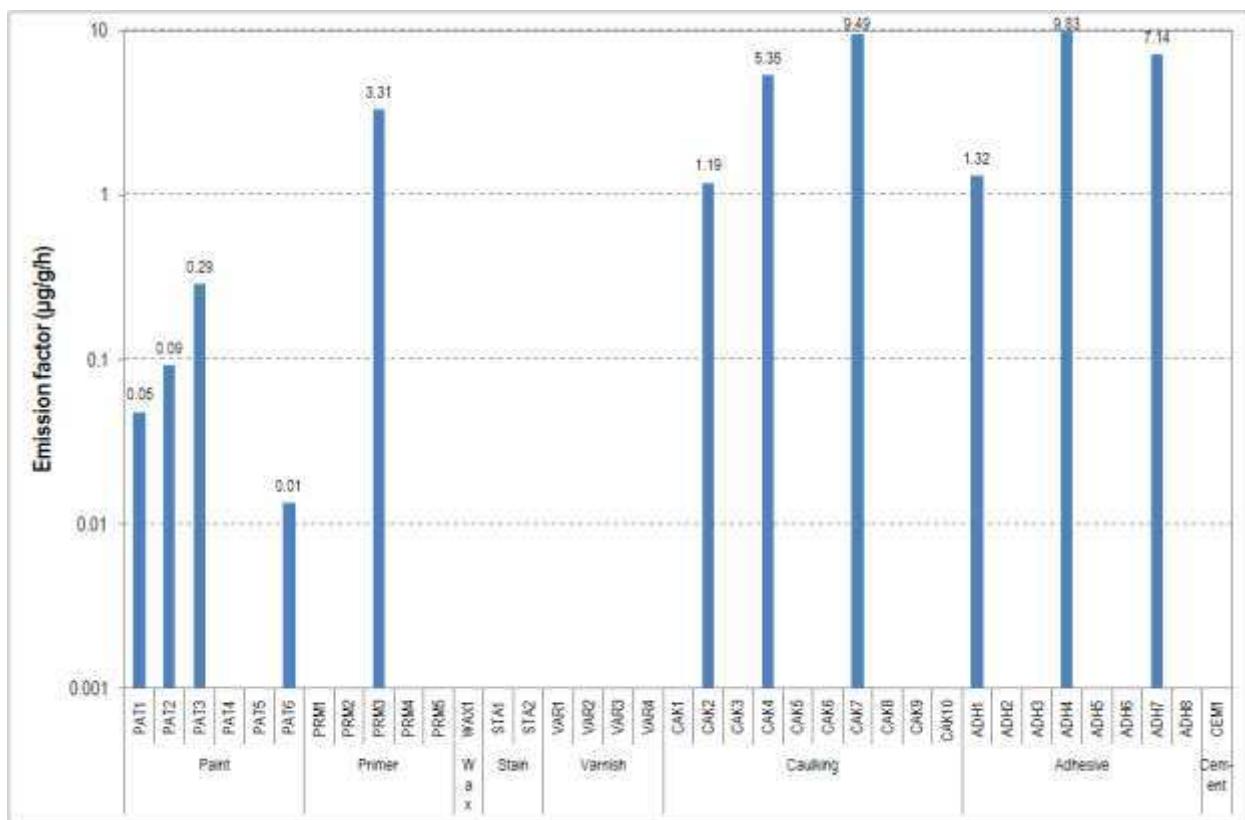


Figure A. 29: Emission factors for liquid building materials (#10: benzaldehyde)

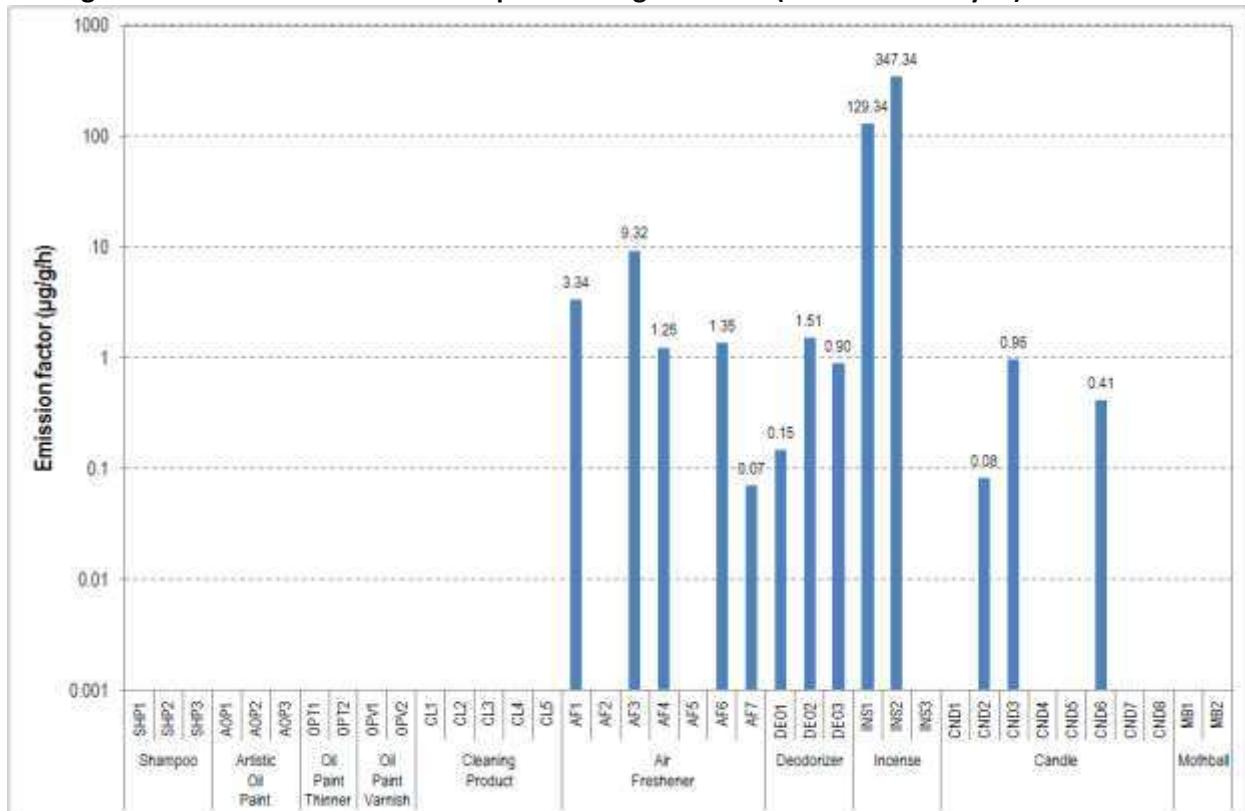


Figure A. 30: Emission factors for consumer/personal-care products (#10: benzaldehyde)

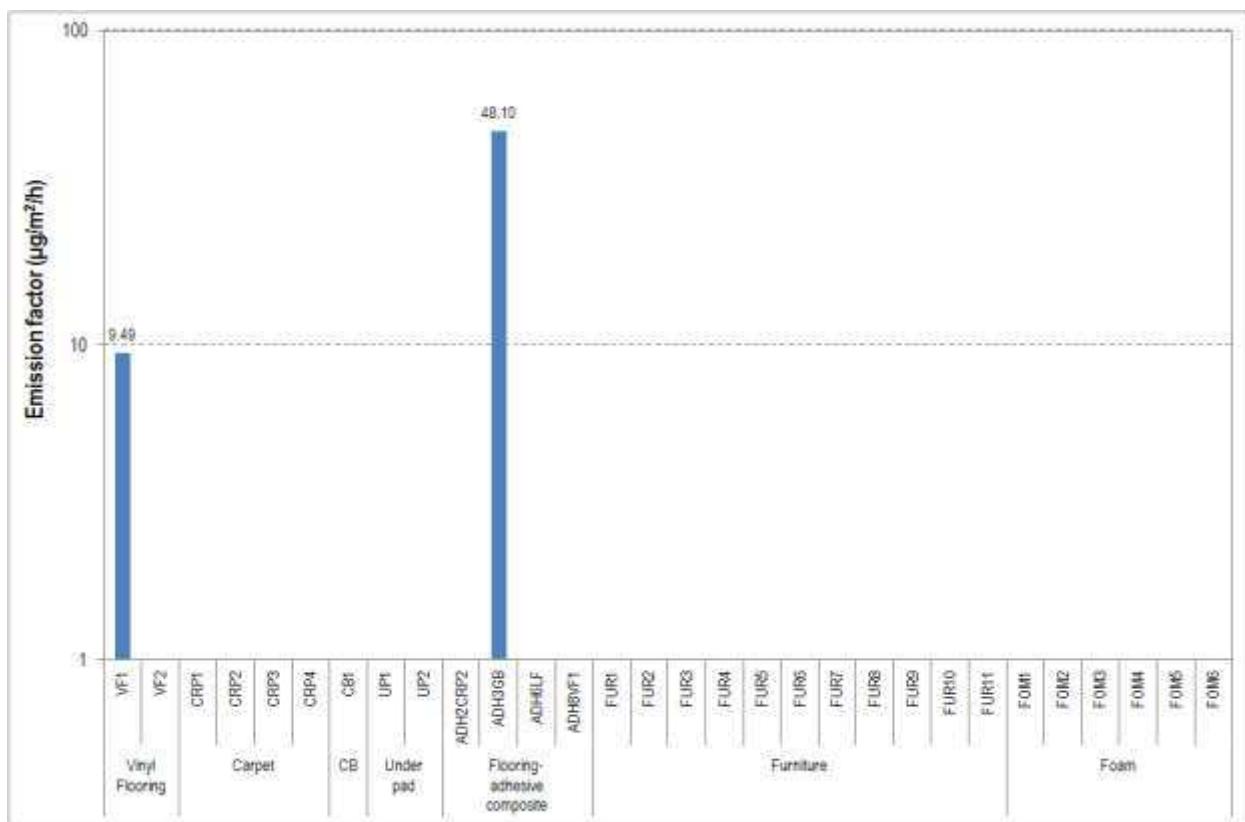


Figure A. 31: Emission factors for solid building materials and furnishings (#11: butanal)

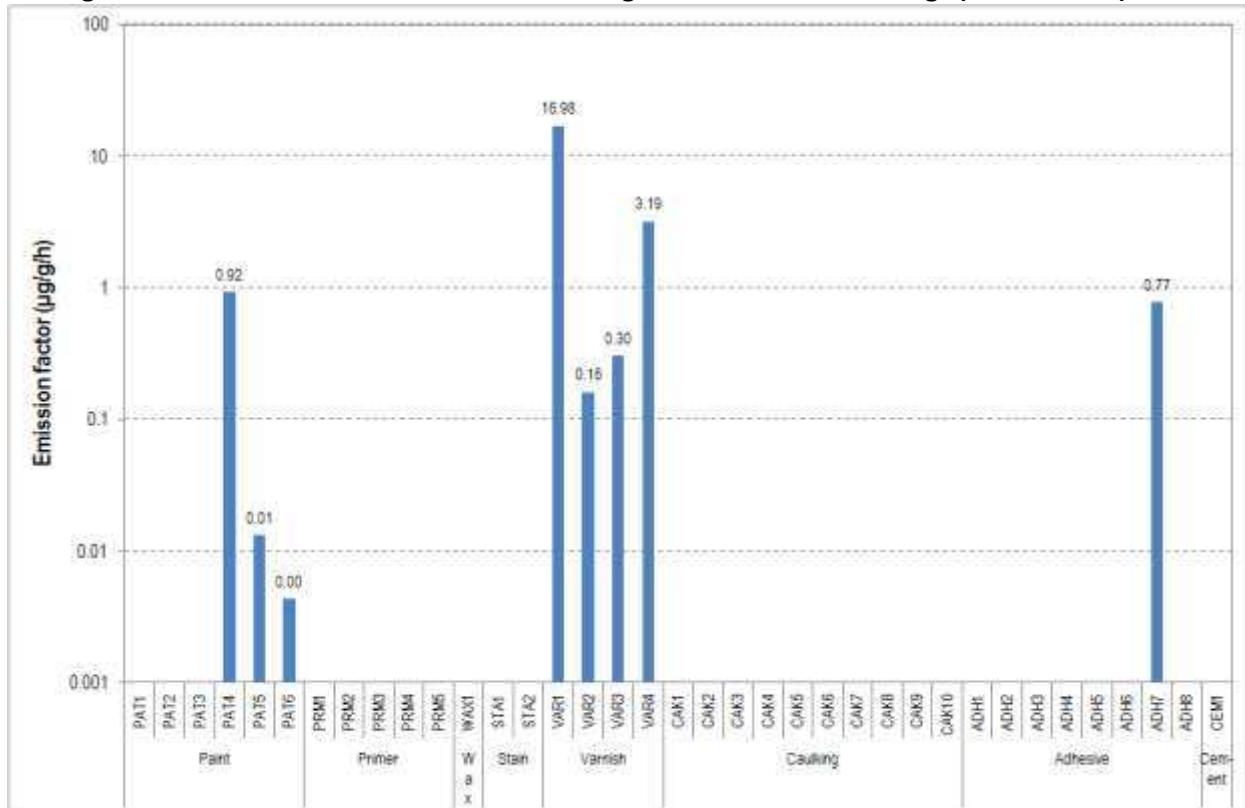


Figure A. 32: Emission factors for liquid building materials (#11: butanal)

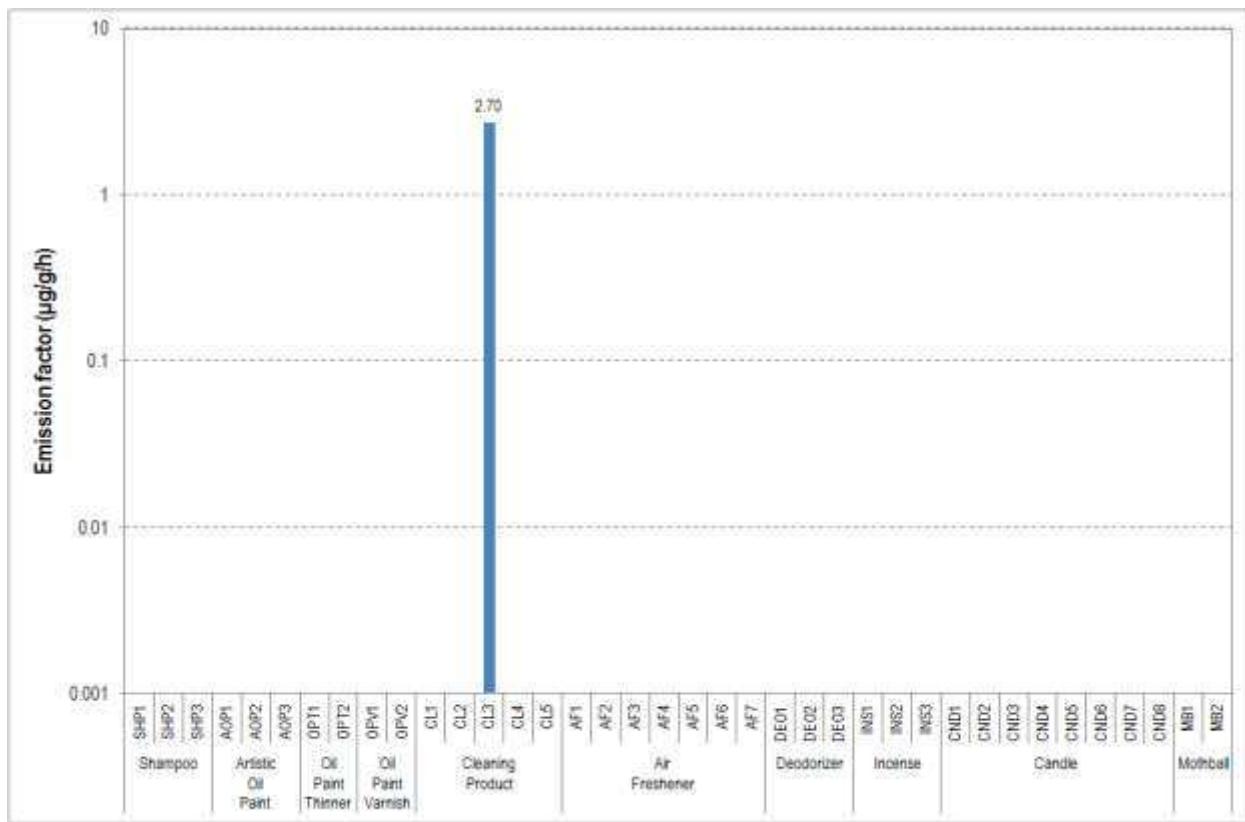


Figure A. 33: Emission factors for consumer/personal-care products (#11: butanal)

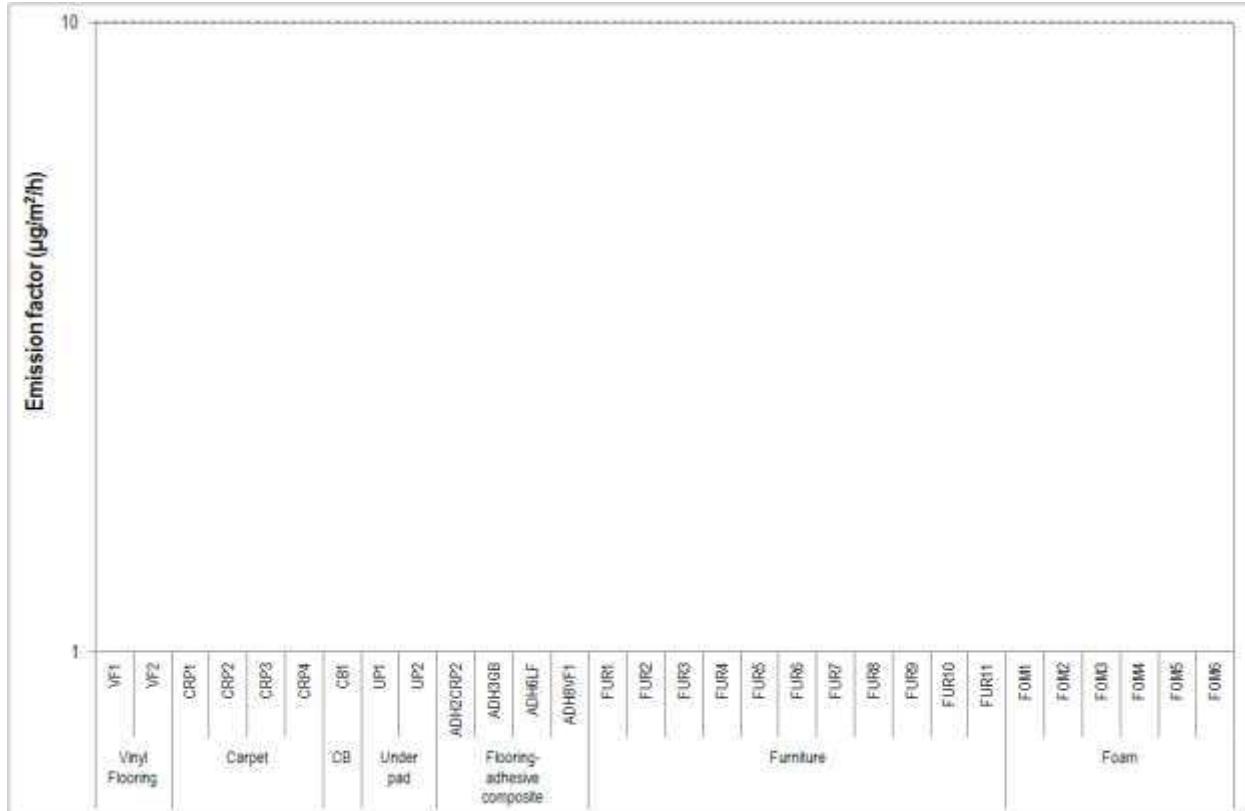


Figure A. 34: Emission factors for solid building materials and furnishings (#12: decanal)

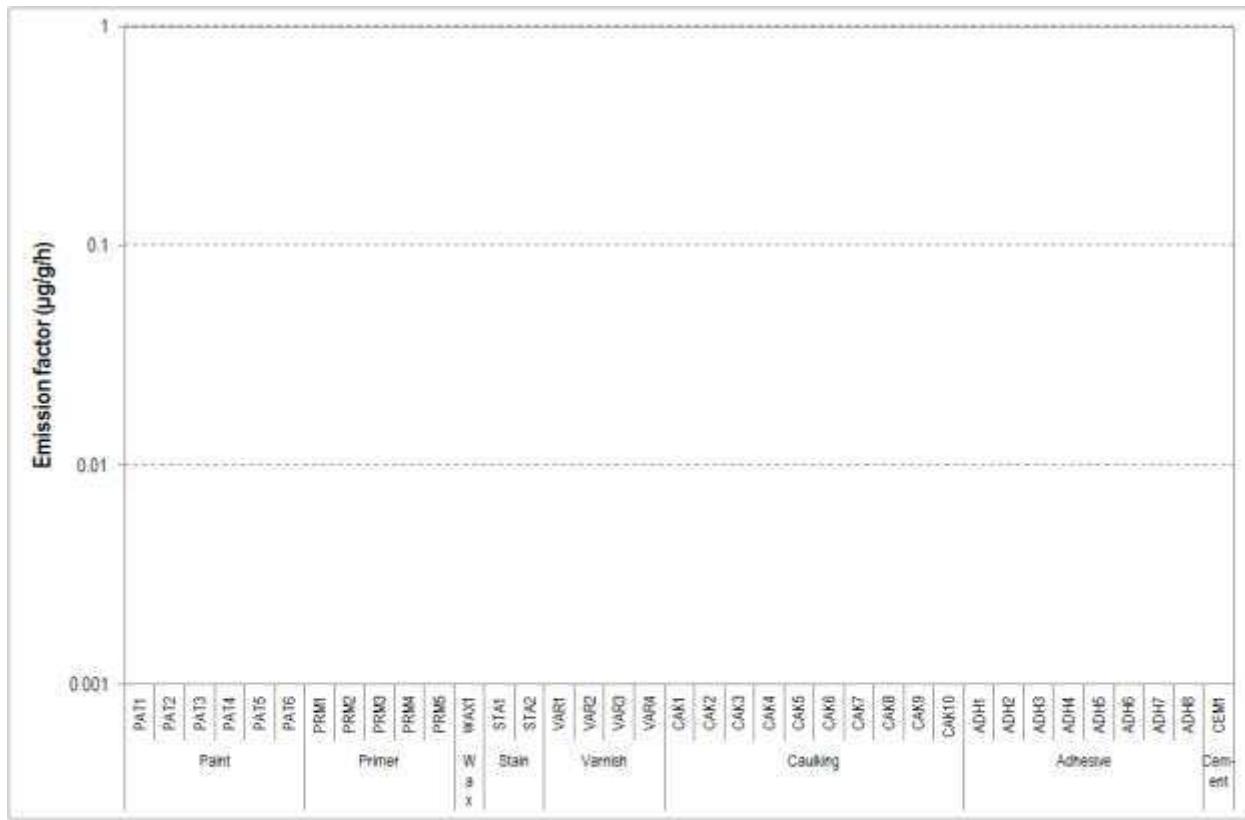


Figure A. 35: Emission factors for liquid building materials (#12: decanal)

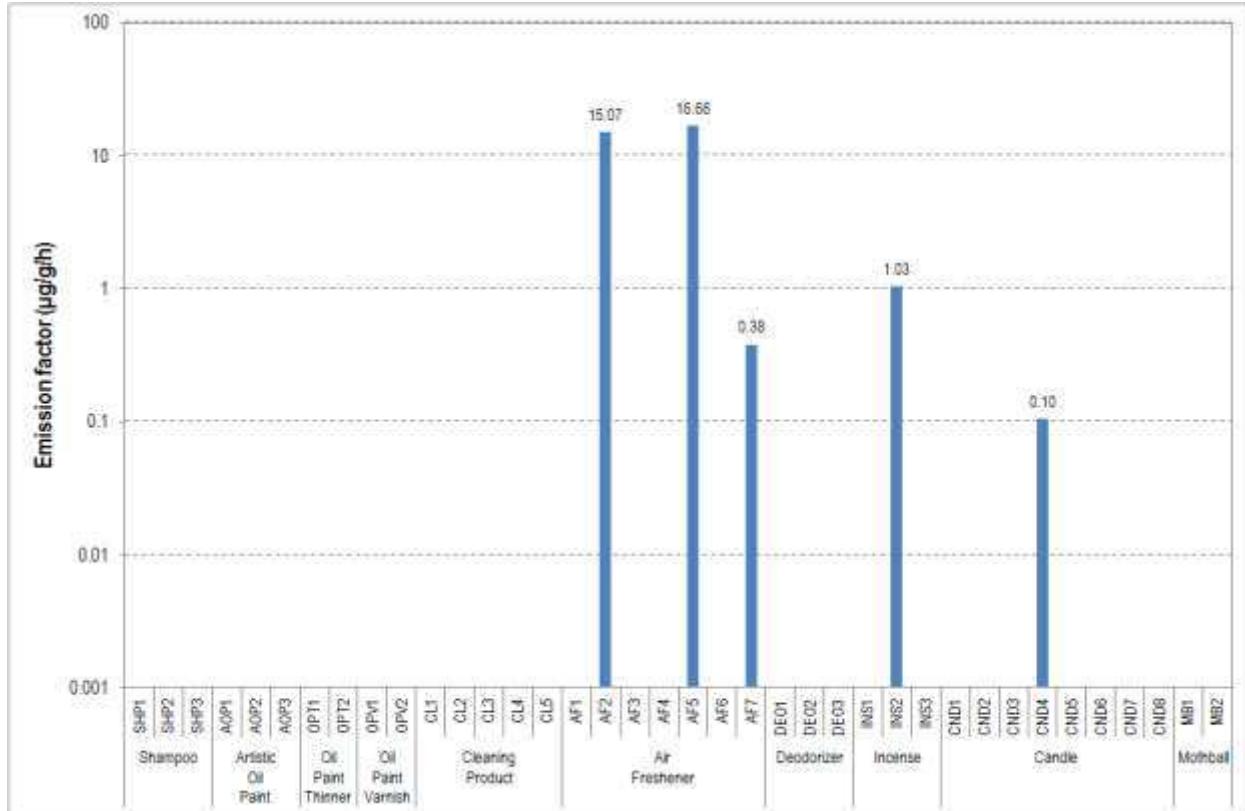


Figure A. 36: Emission factors for consumer/personal-care products (#12: decanal)

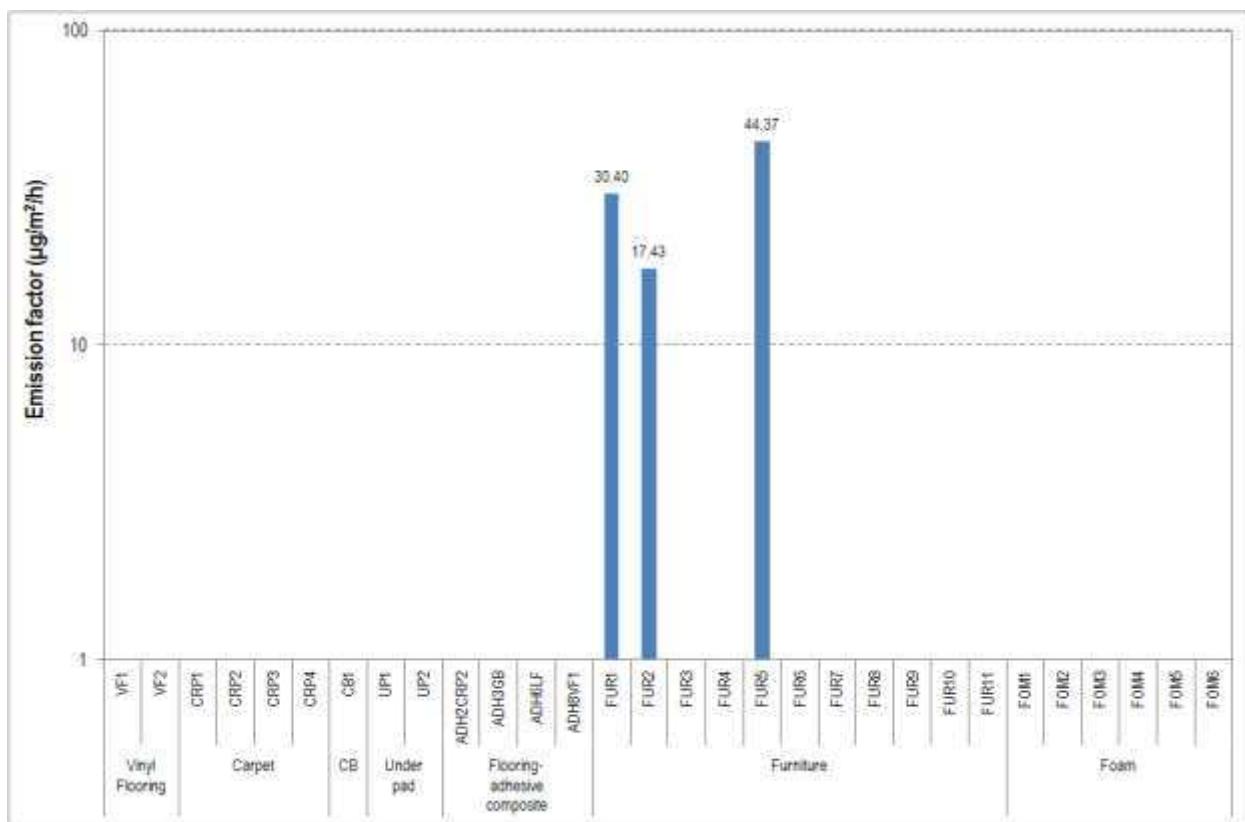


Figure A. 37: Emission factors for solid building materials and furnishings (#13: heptanal)

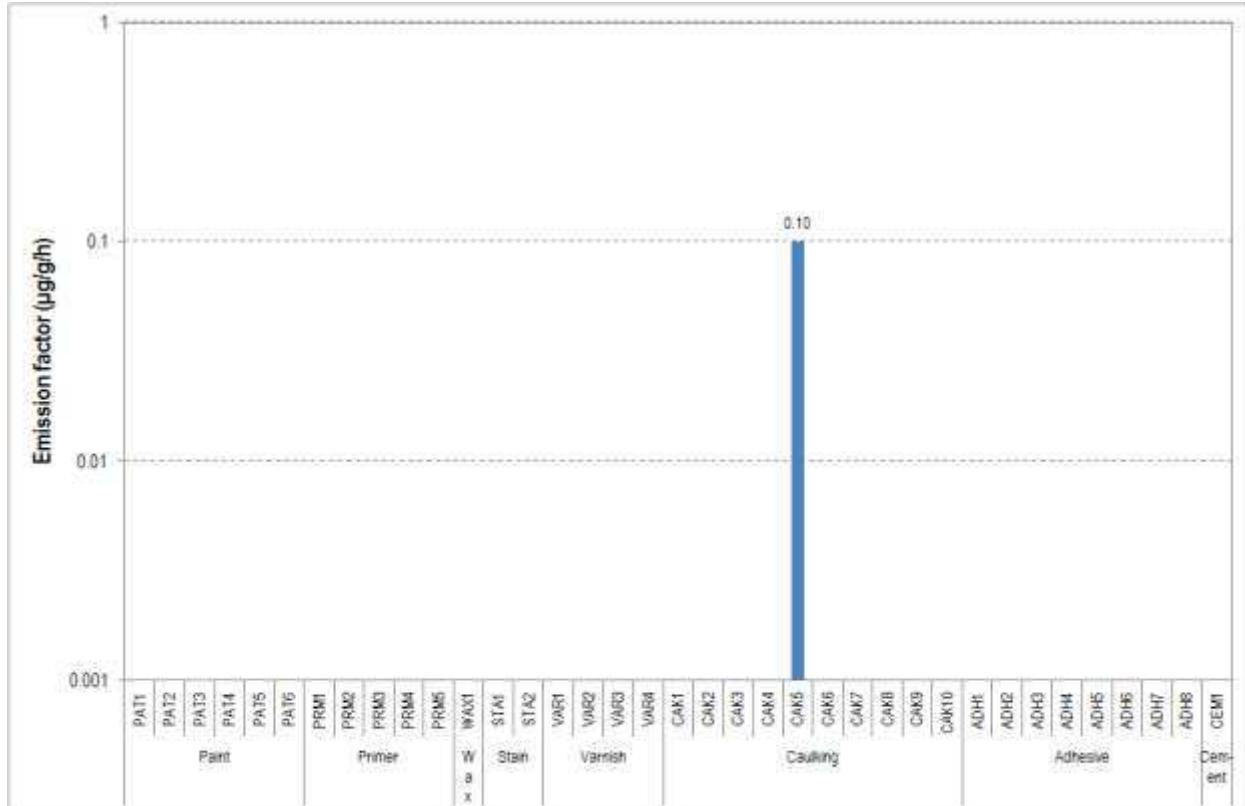


Figure A. 38: Emission factors for liquid building materials (#13: heptanal)

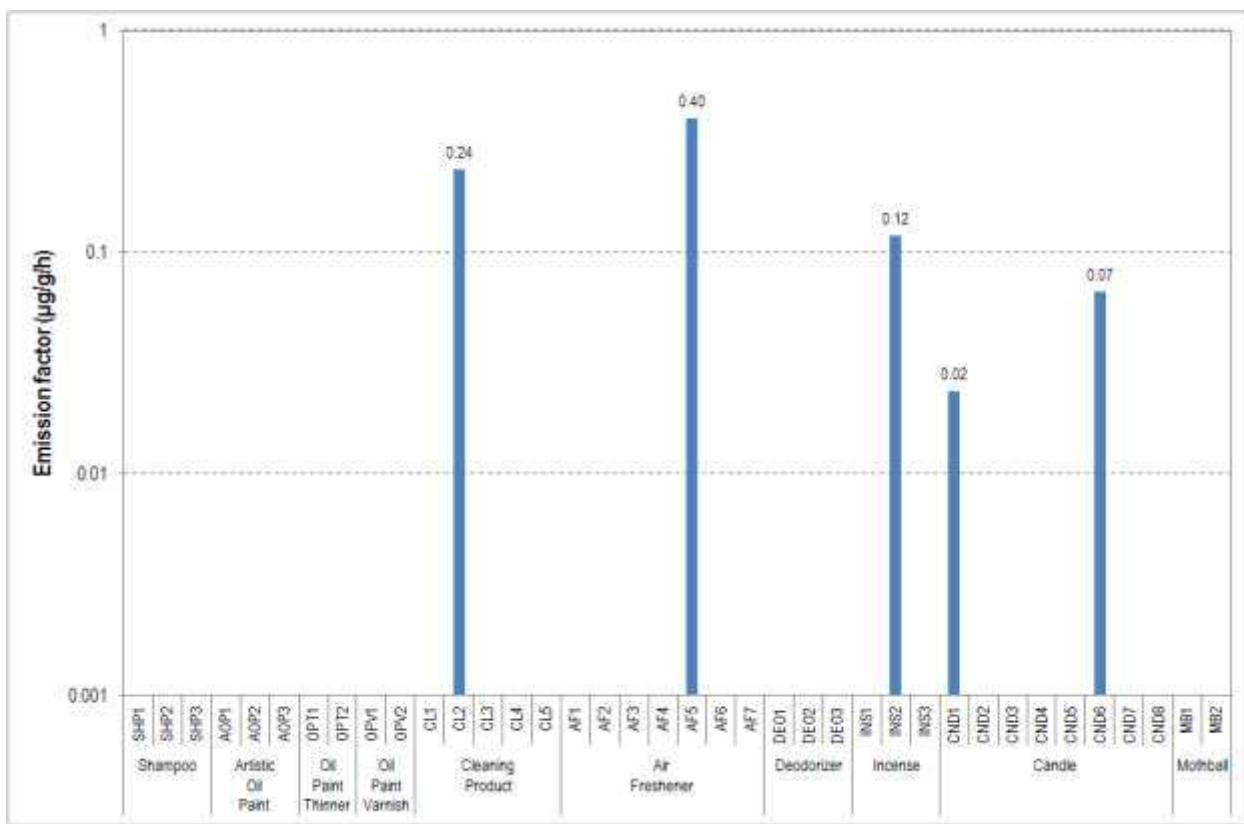


Figure A. 39: Emission factors for consumer/personal-care products (#13: heptanal)

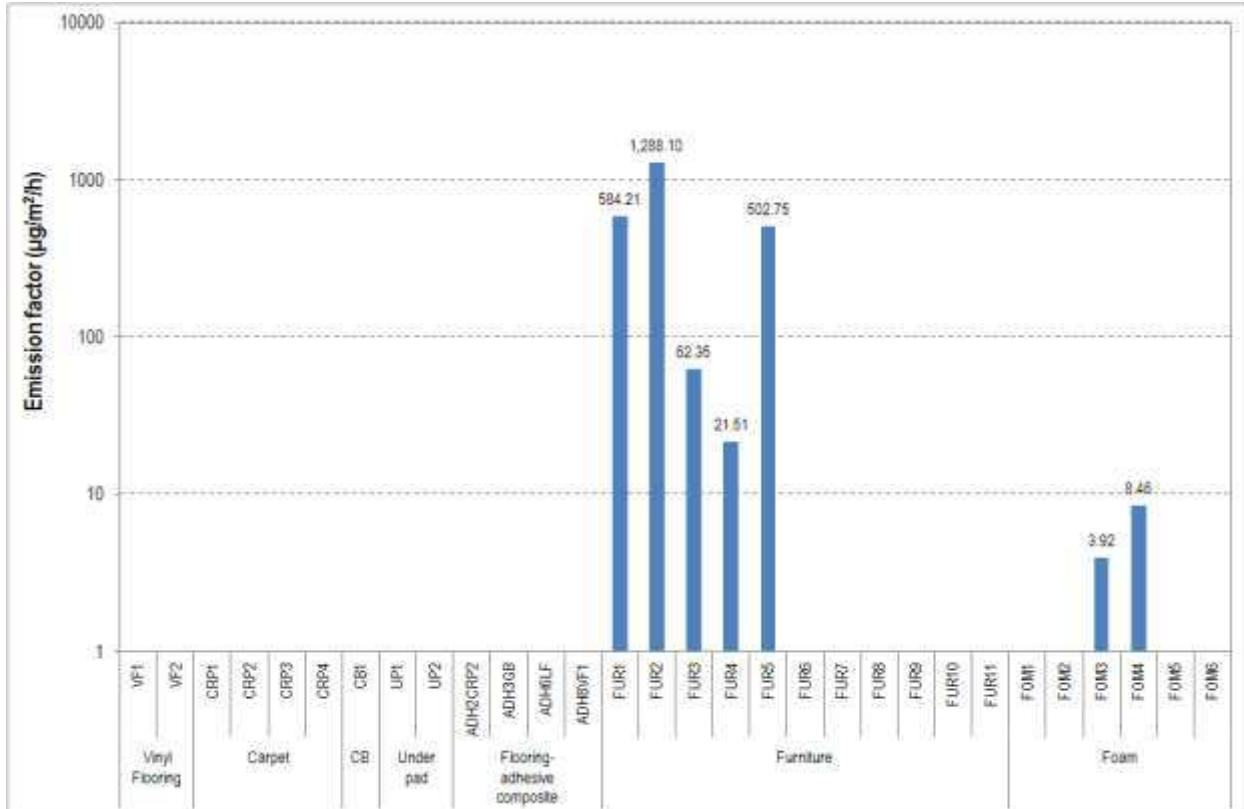


Figure A. 40: Emission factors for solid building materials and furnishings (#14: hexanal)

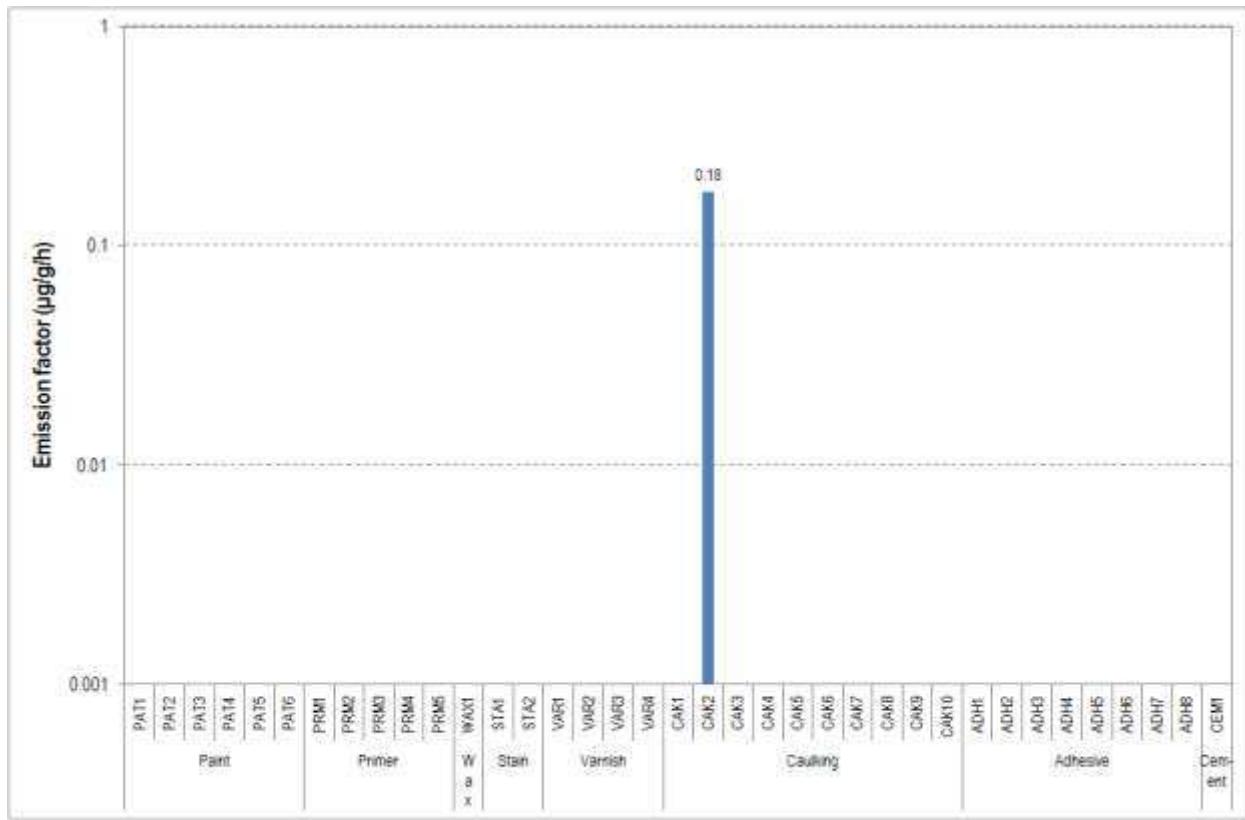


Figure A. 41: Emission factors for liquid building materials (#14: hexanal)

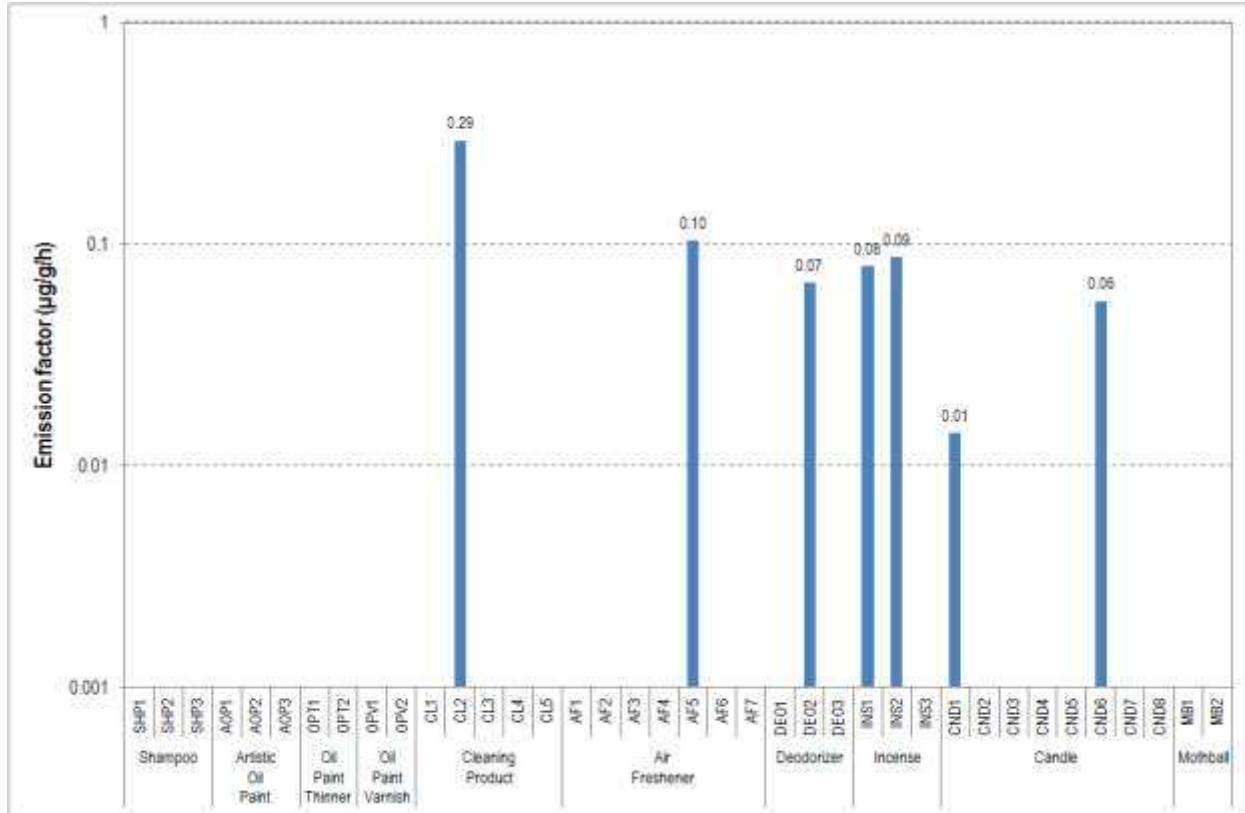


Figure A. 42: Emission factors for consumer/personal-care products (#14: hexanal)

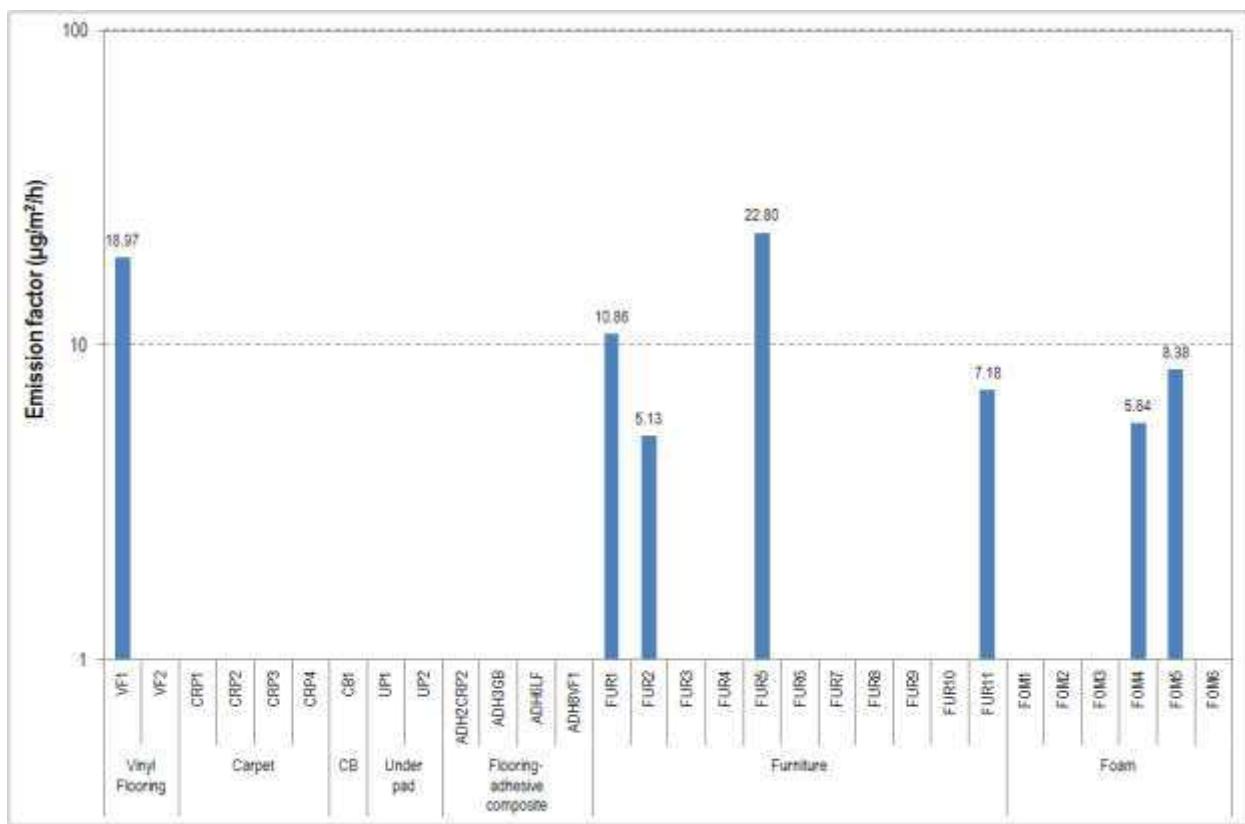


Figure A. 43: Emission factors for solid building materials and furnishings (#15: nonanal)

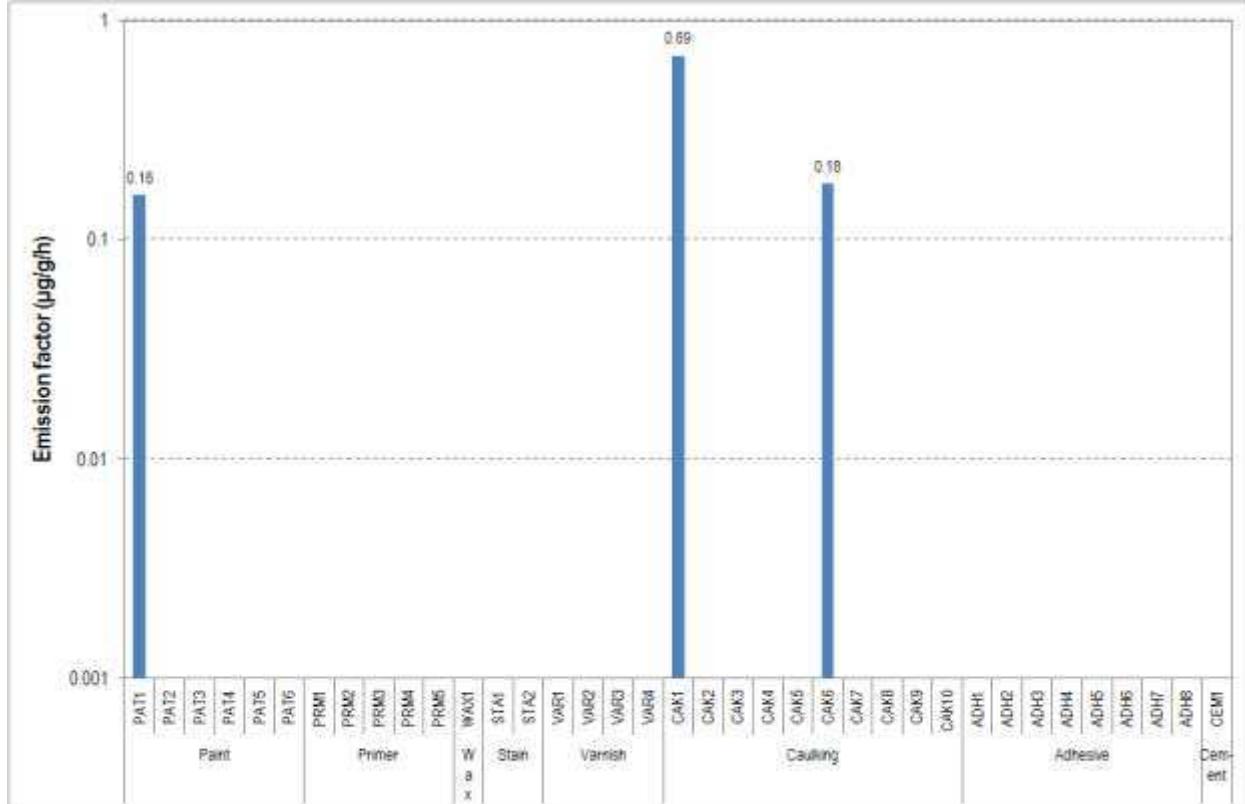


Figure A. 44: Emission factors for liquid building materials (#15: nonanal)

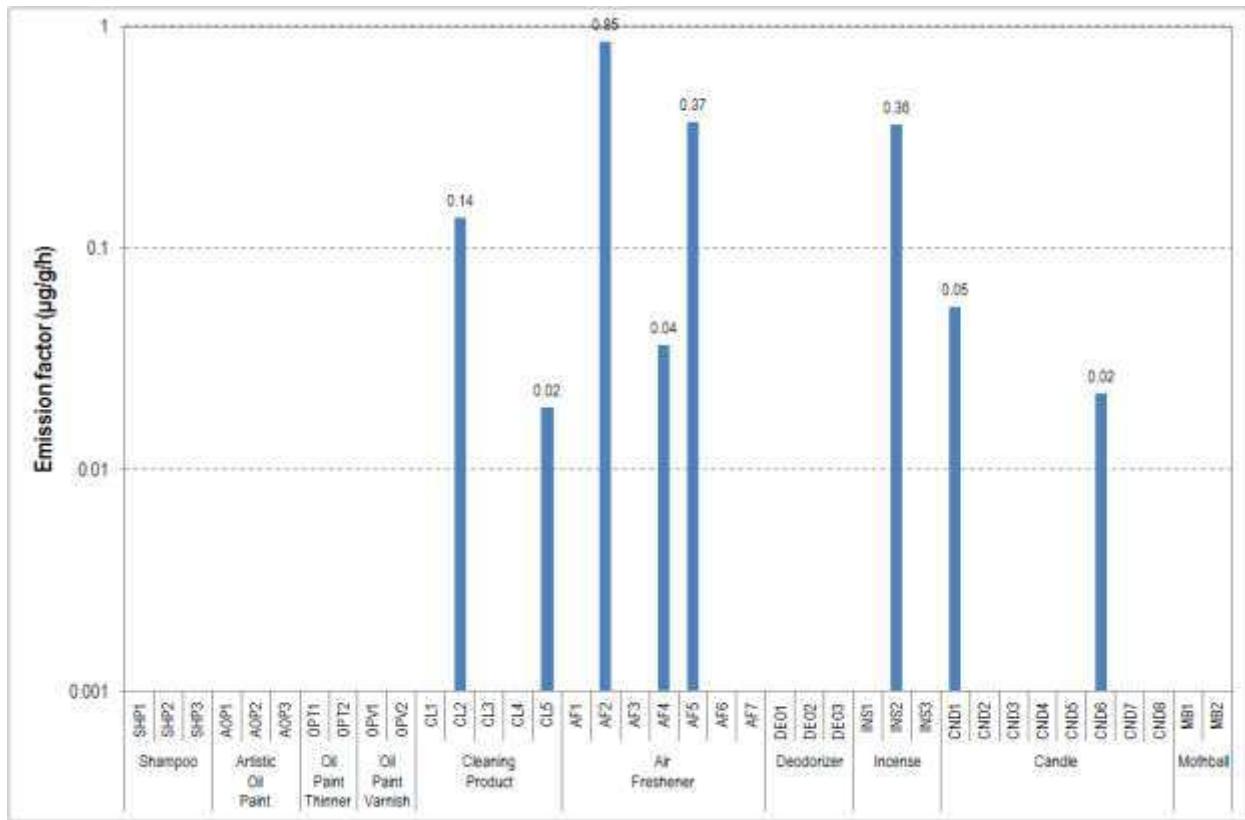


Figure A. 45: Emission factors for consumer/personal-care products (#15: nonanal)

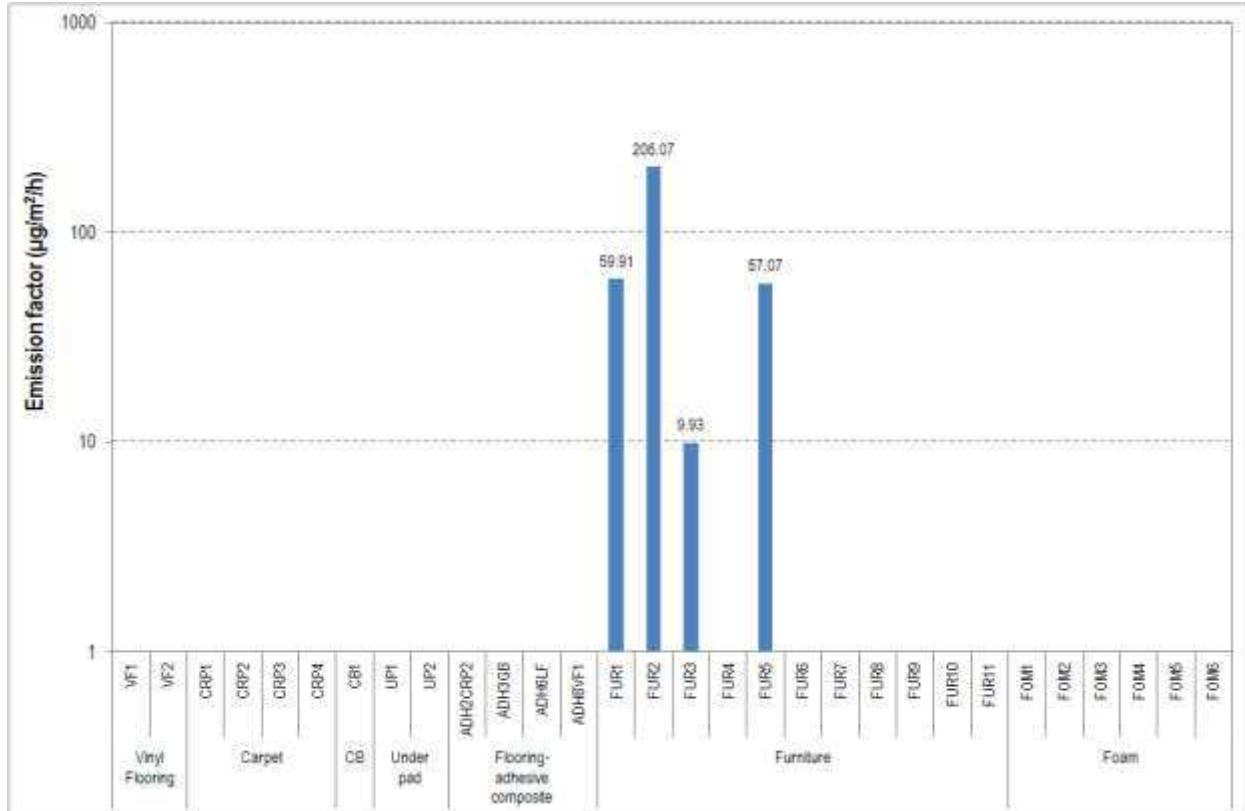


Figure A. 46: Emission factors for solid building materials and furnishings (#16: pentanal)

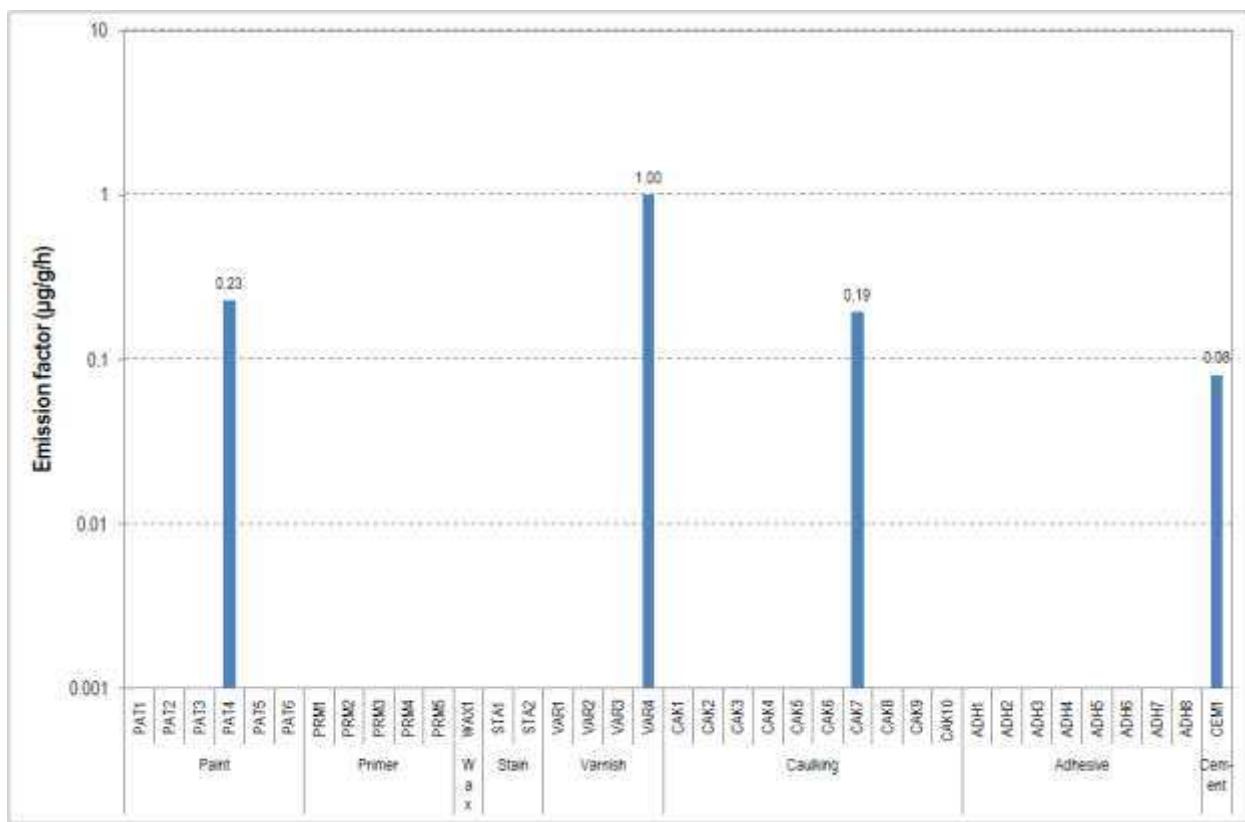


Figure A. 47: Emission factors for liquid building materials (#16: pentanal)

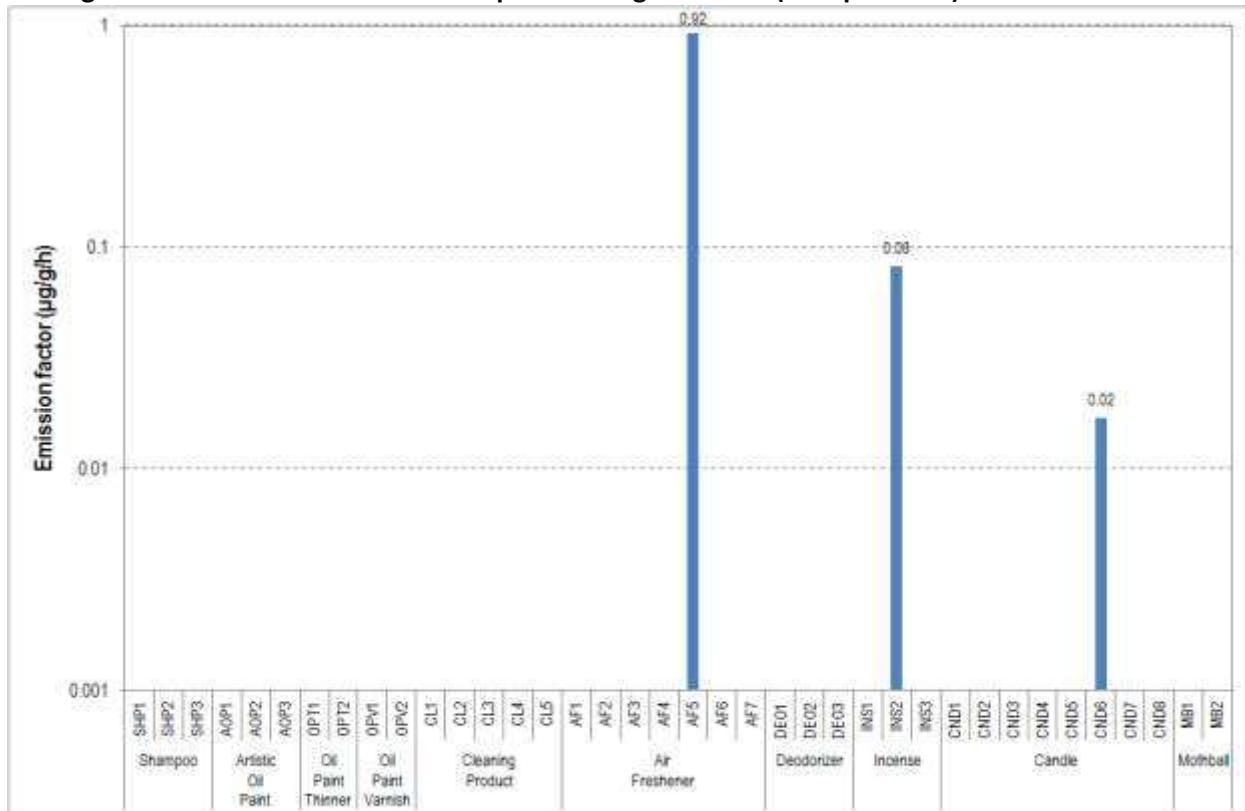


Figure A. 48: Emission factors for consumer/personal-care products (#16: pentanal)

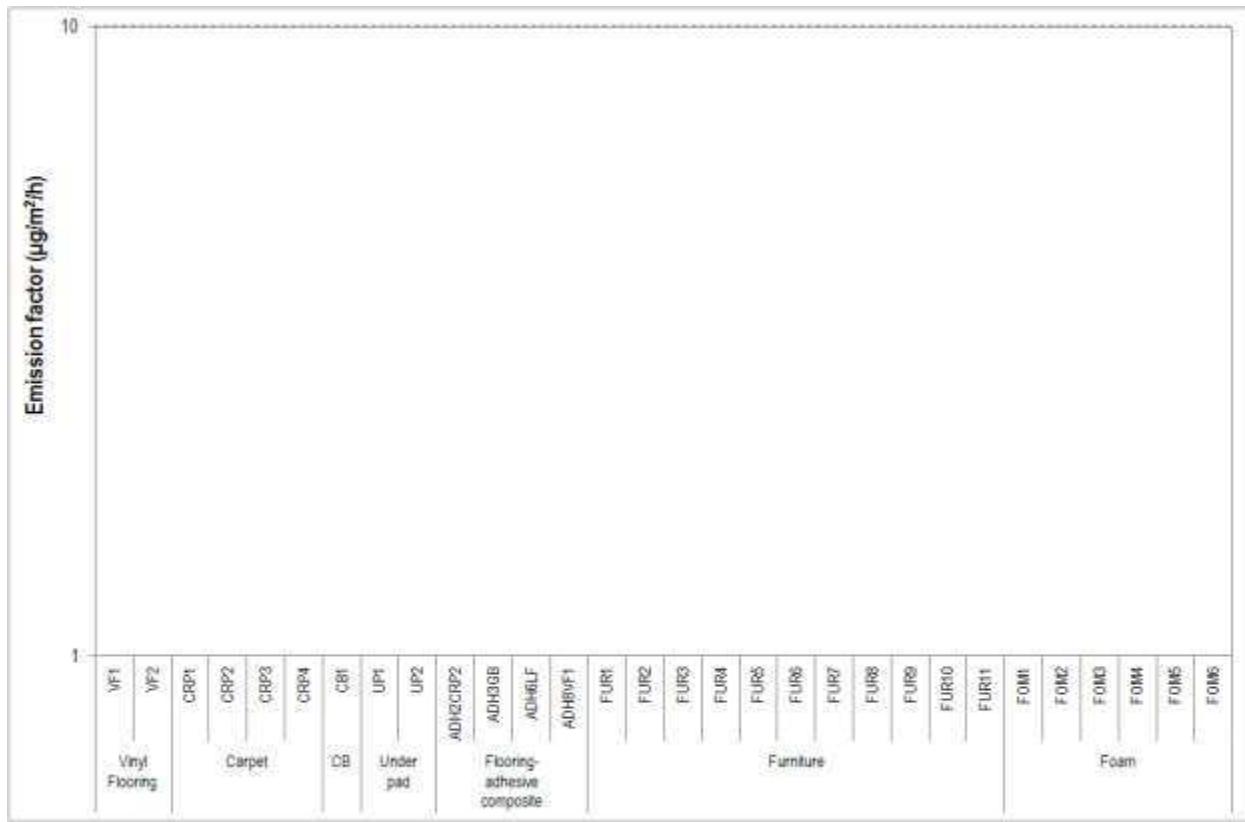


Figure A. 49: Emission factors for solid building materials and furnishings (#17: 2,2,4-trimethylpentane)

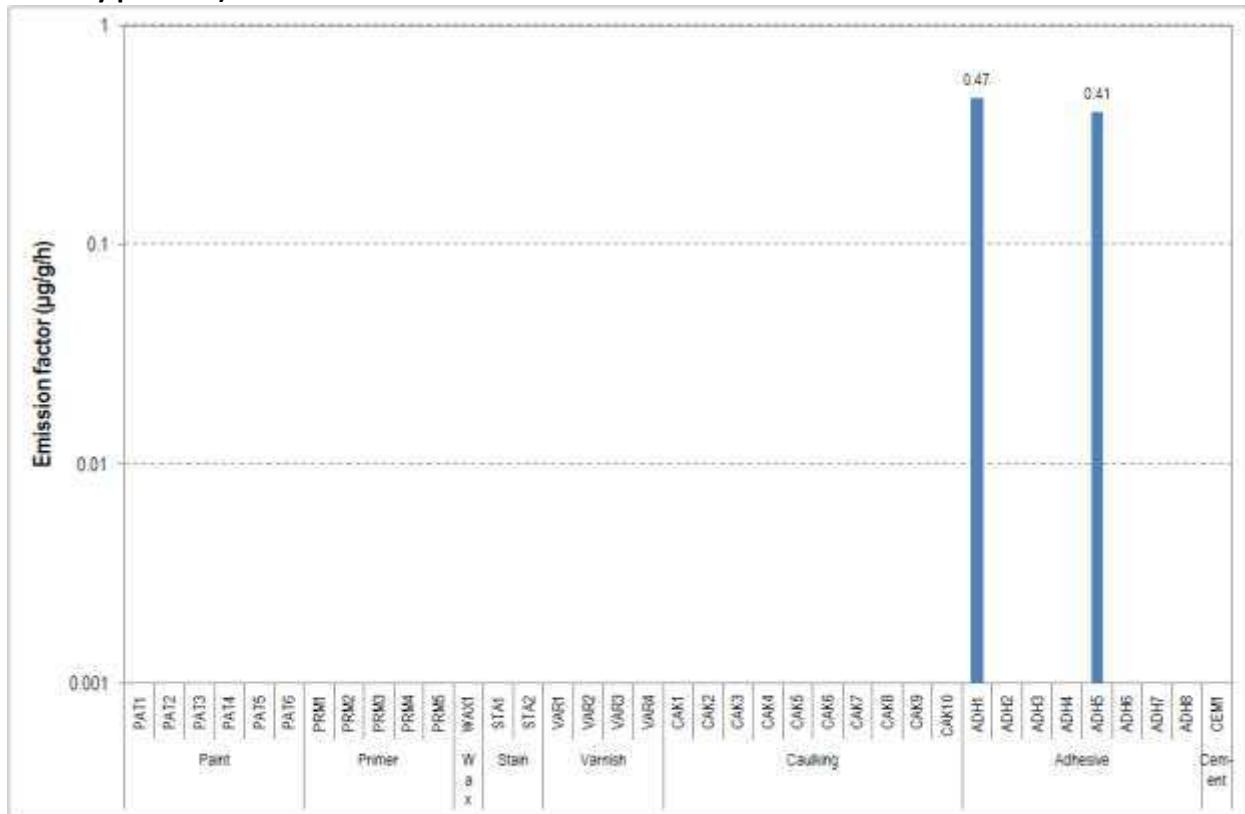


Figure A. 50: Emission factors for liquid building materials (#17: 2,2,4-trimethylpentane)

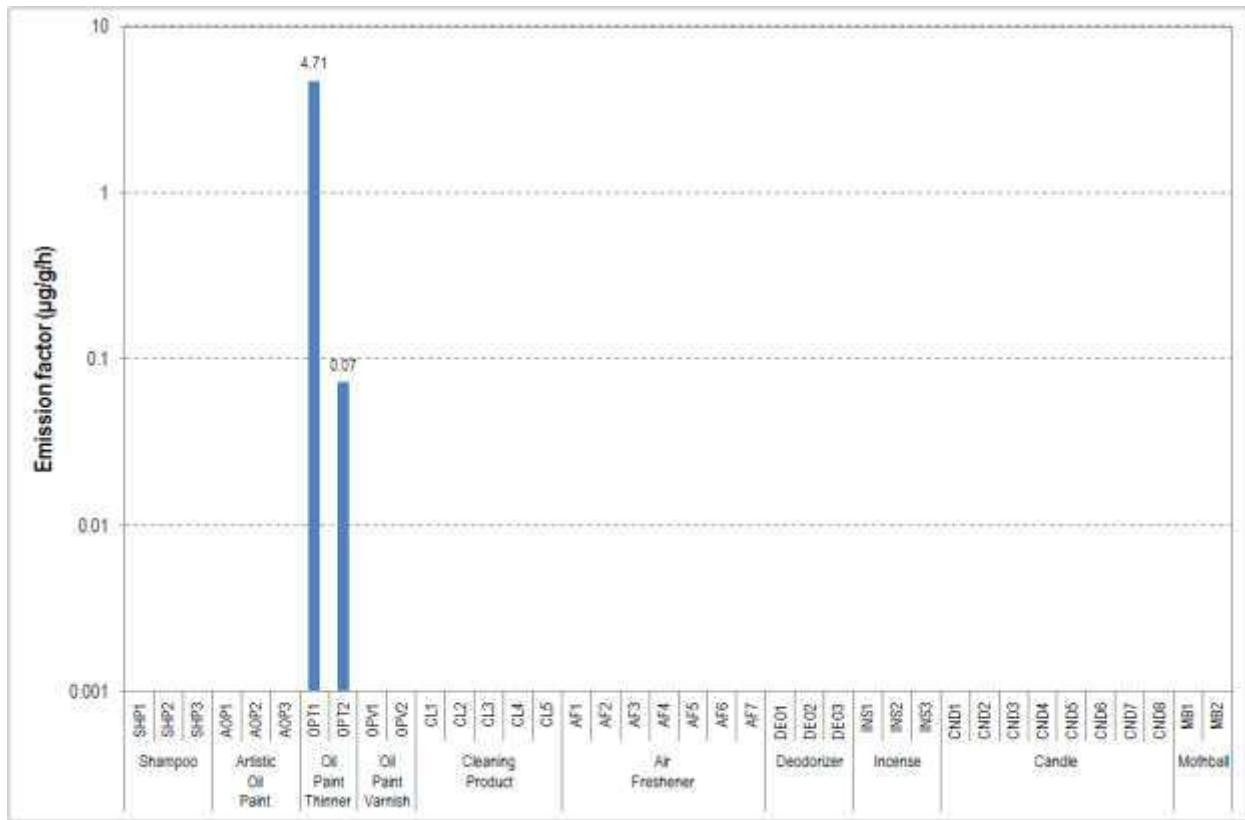


Figure A. 51: Emission factors for consumer/personal-care (#17: 2,2,4-trimethylpentane)

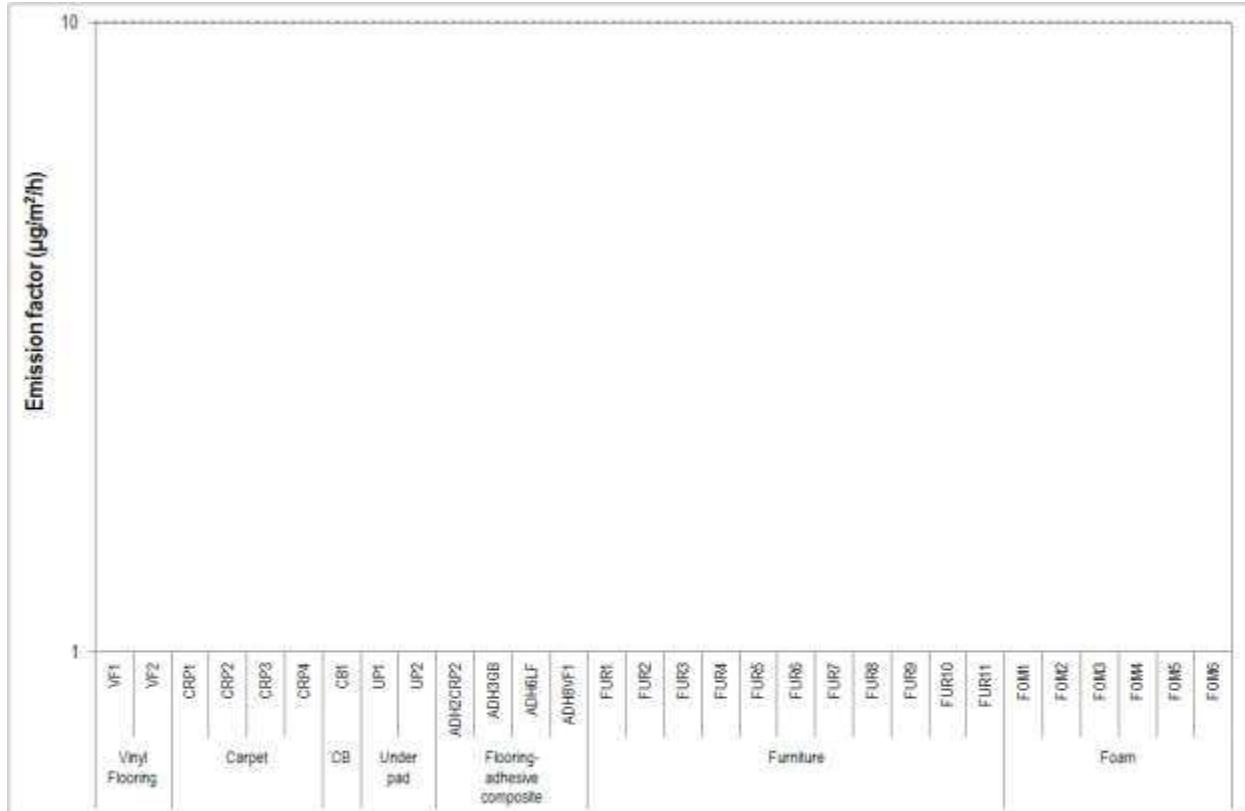


Figure A. 52: Emission factors for solid building materials and furnishings (#18: 2,4-dimethylpentane)

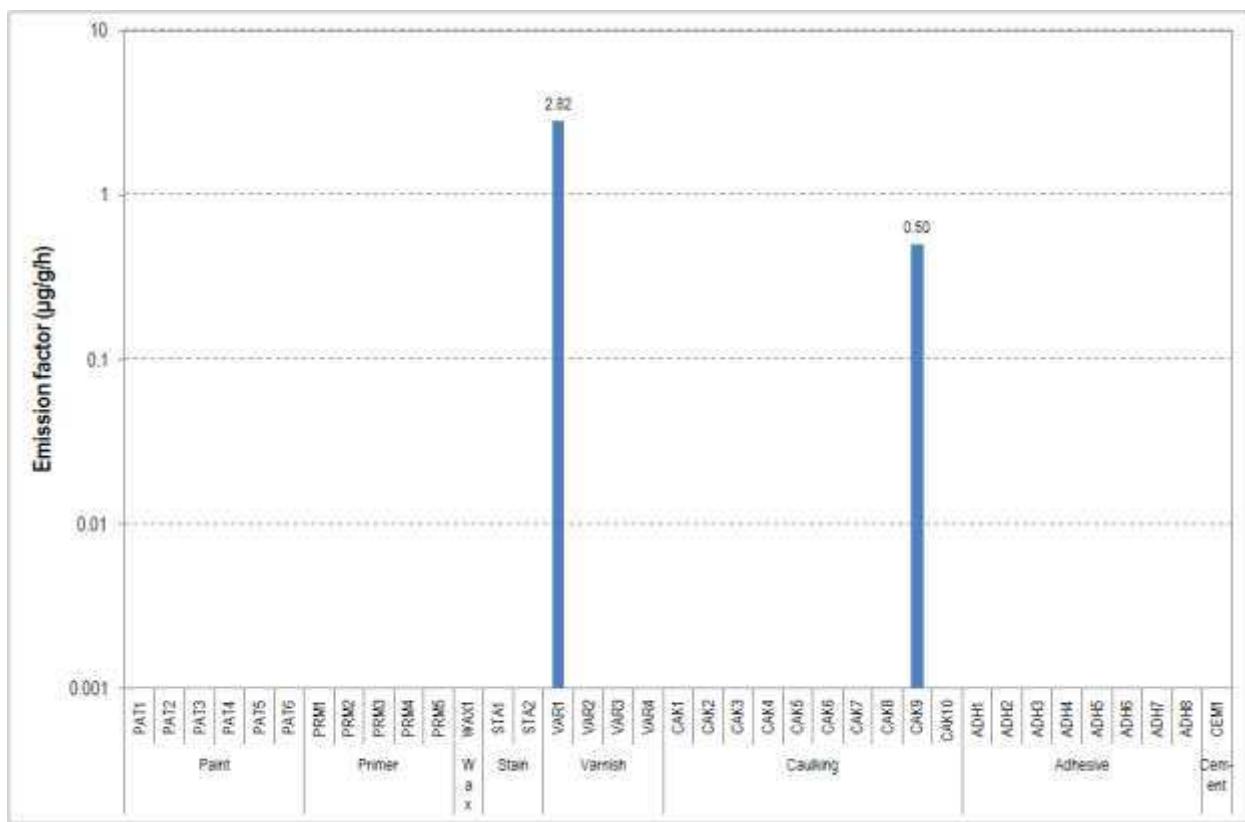


Figure A. 53: Emission factors for liquid building materials (#18: 2,4-dimethylpentane)

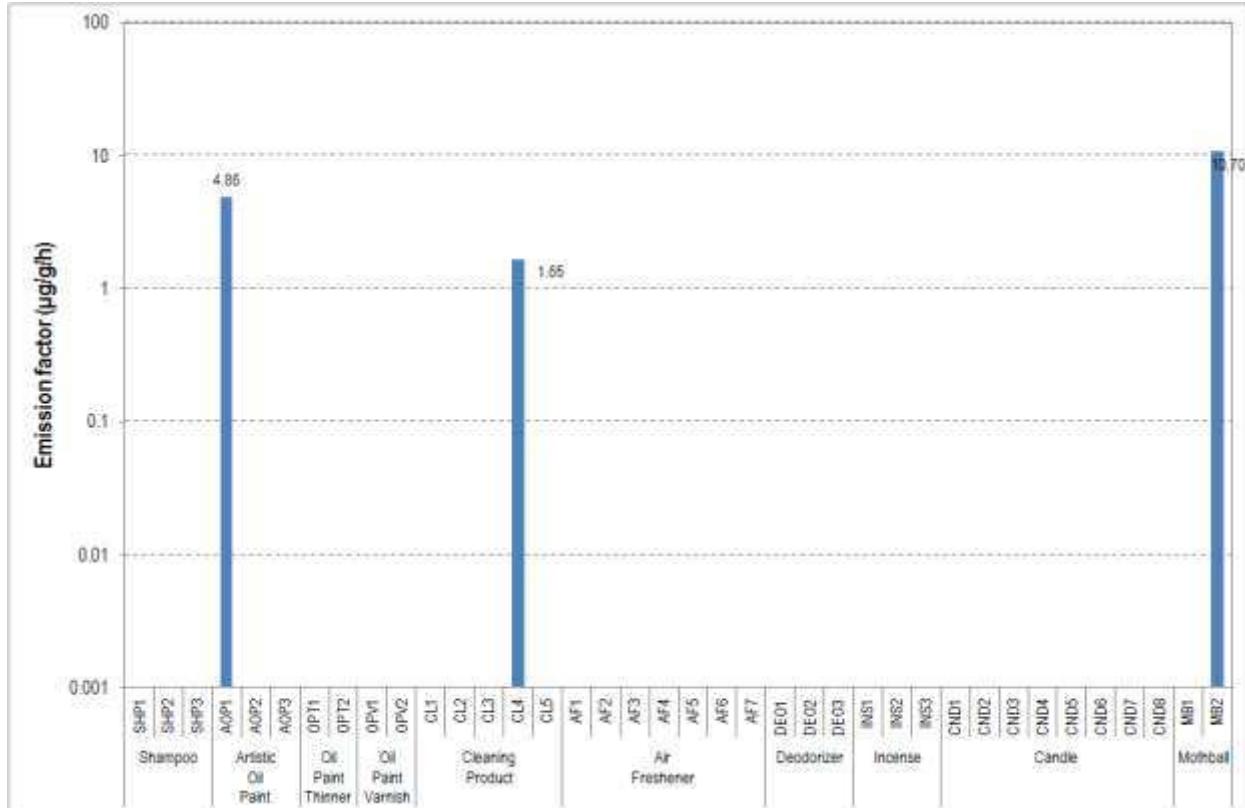


Figure A. 54: Emission factors for consumer/personal-care products (#18: 2,4-dimethylpentane)

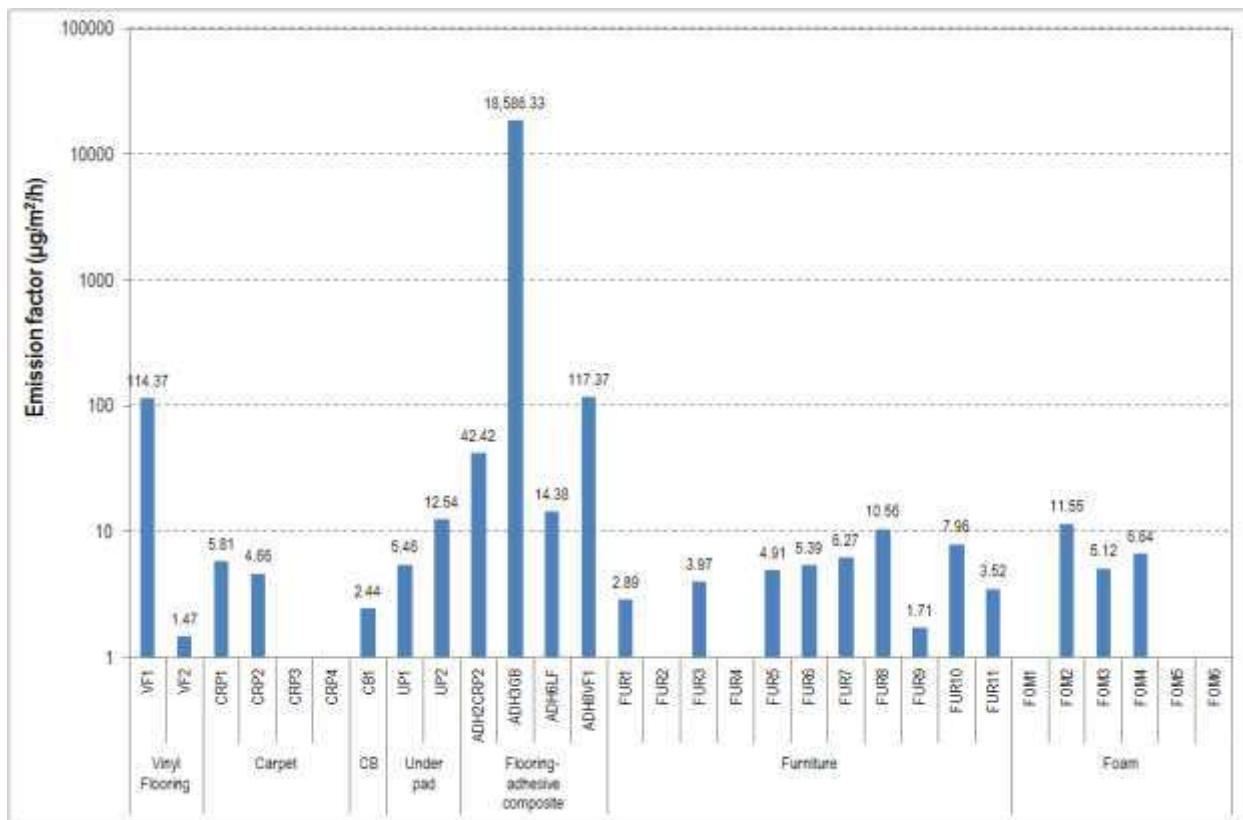


Figure A. 55: Emission factors for solid building materials and furnishings (#19: decane)

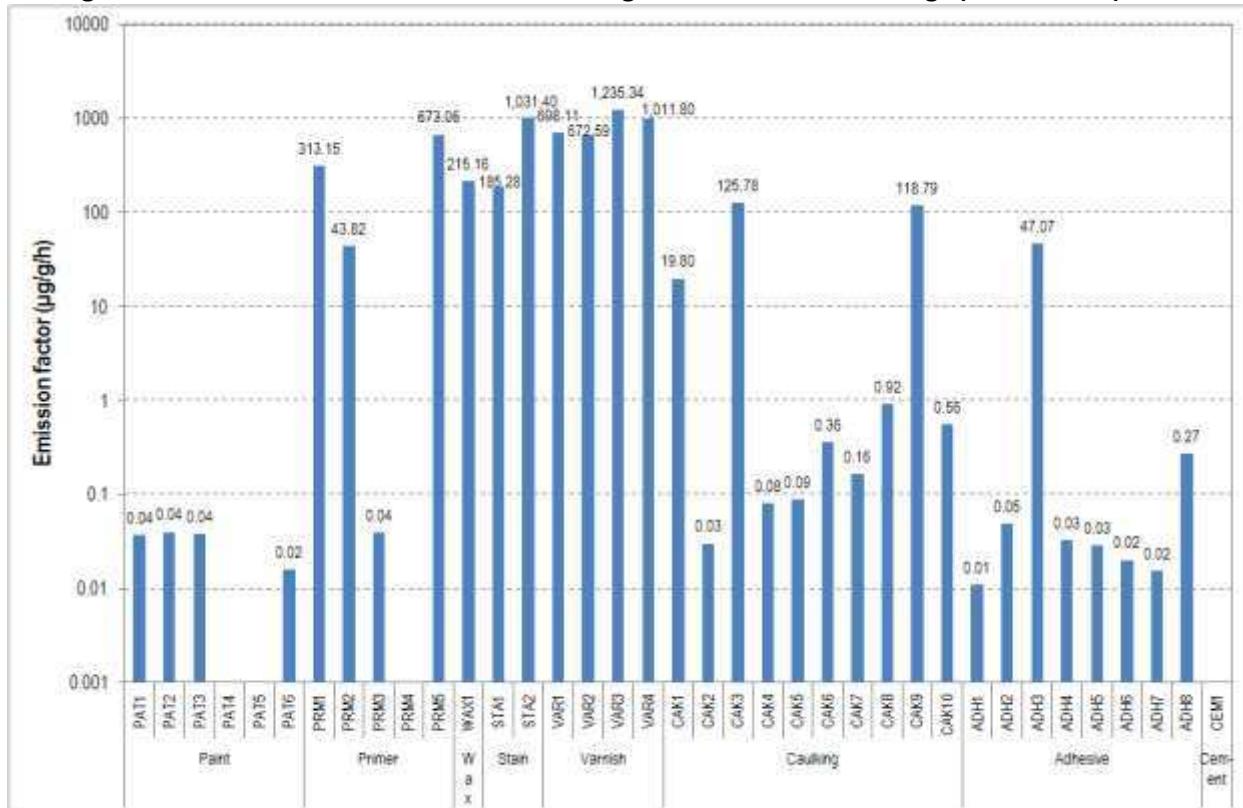


Figure A. 56: Emission factors for liquid building materials (#19: decane)

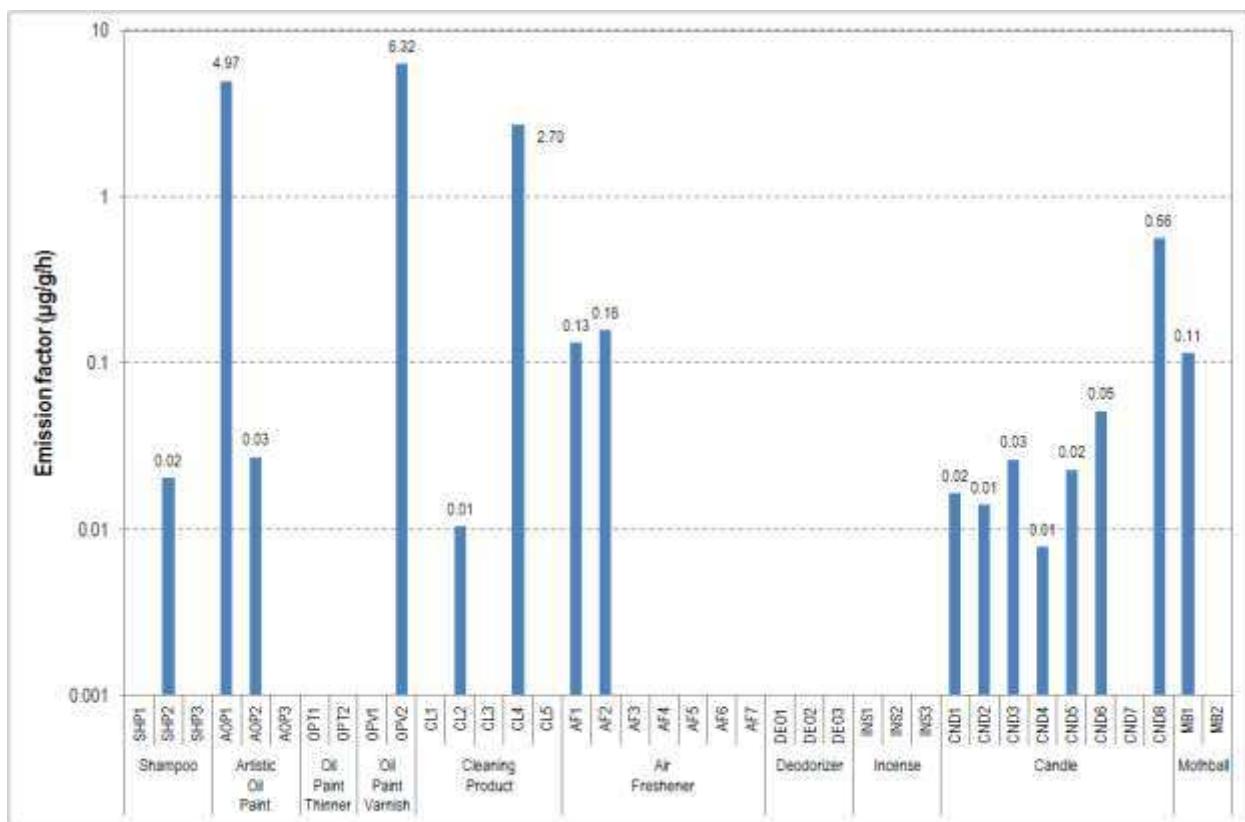


Figure A. 57: Emission factors for consumer/personal-care products (#19: decane)

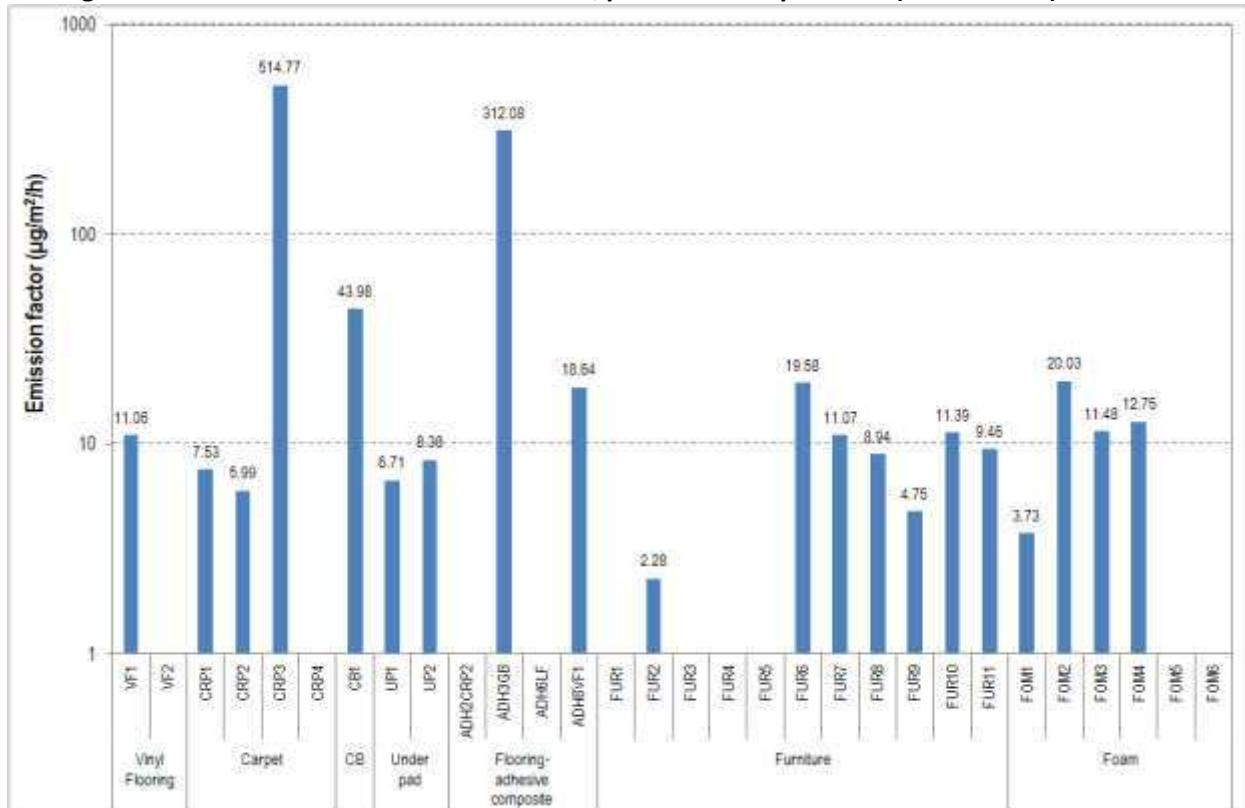


Figure A. 58: Emission factors for solid building materials and furnishings (#20: dodecane)

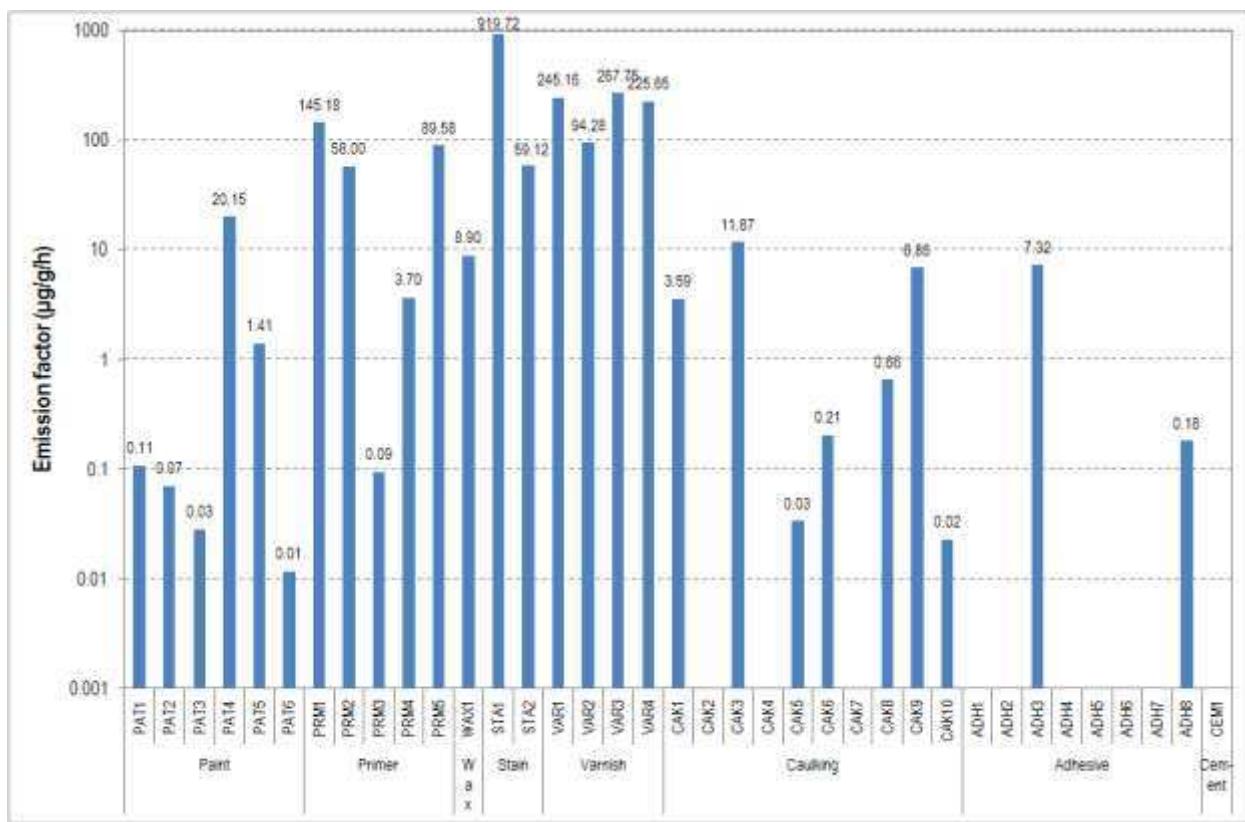


Figure A. 59: Emission factors for liquid building materials (#20: dodecane)

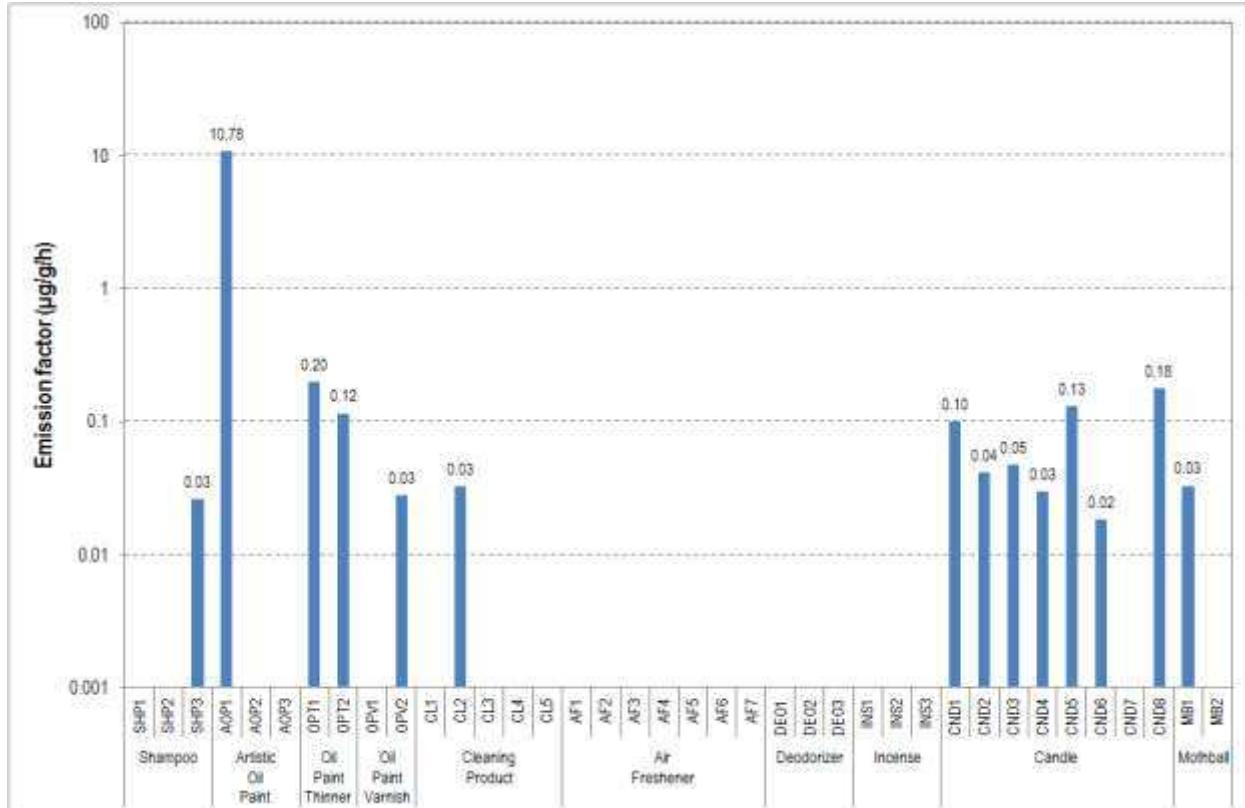


Figure A. 60: Emission factors for consumer/personal-care products (#20: dodecane)

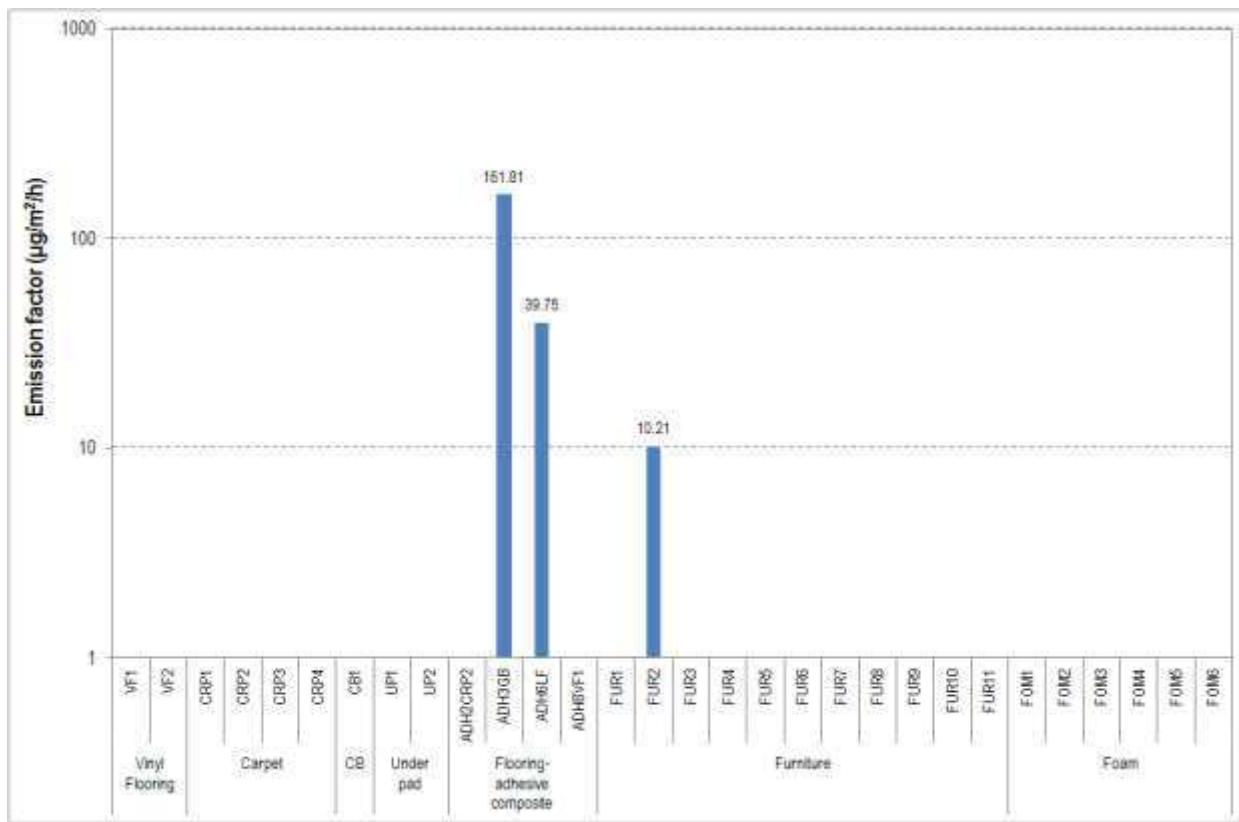


Figure A. 61: Emission factors for solid building materials and furnishings (#21: heptane)

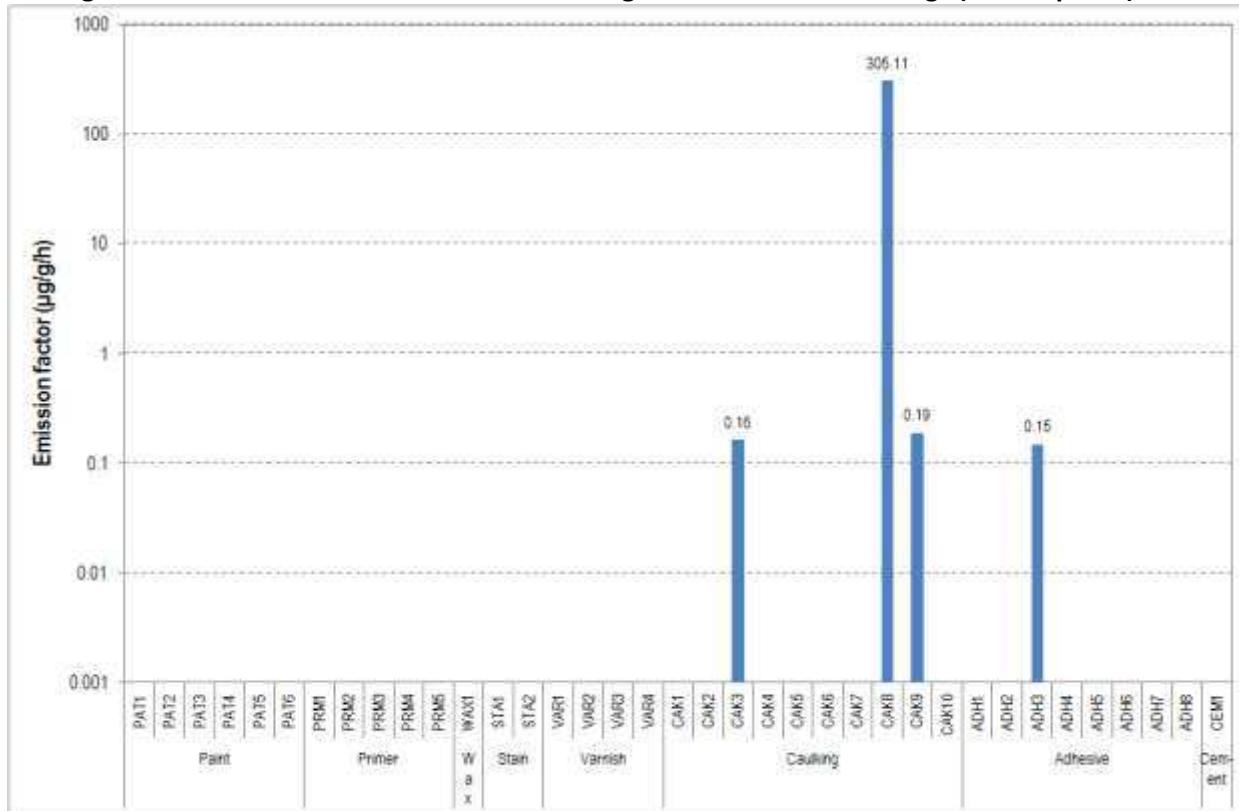


Figure A. 62: Emission factors for liquid building materials (#21: heptane)

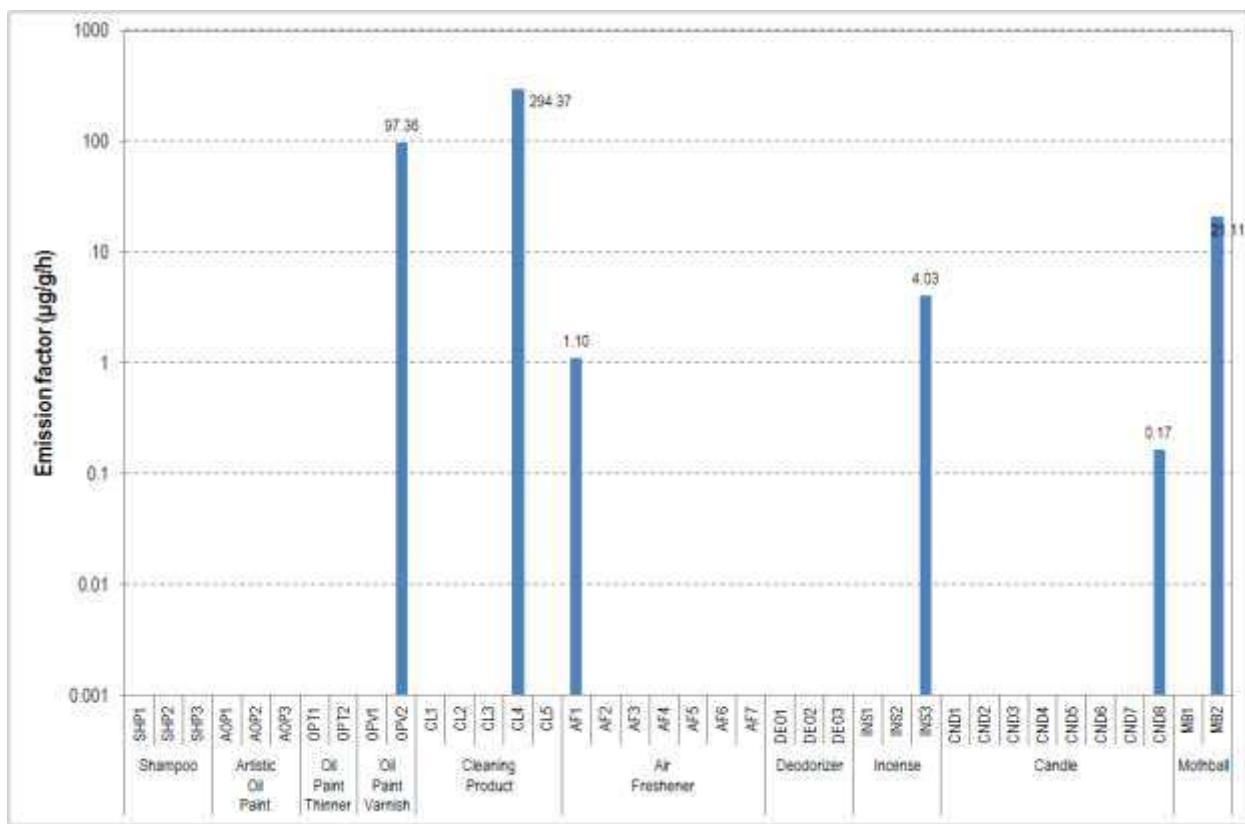


Figure A. 63: Emission factors for consumer/personal-care products (#21: heptane)

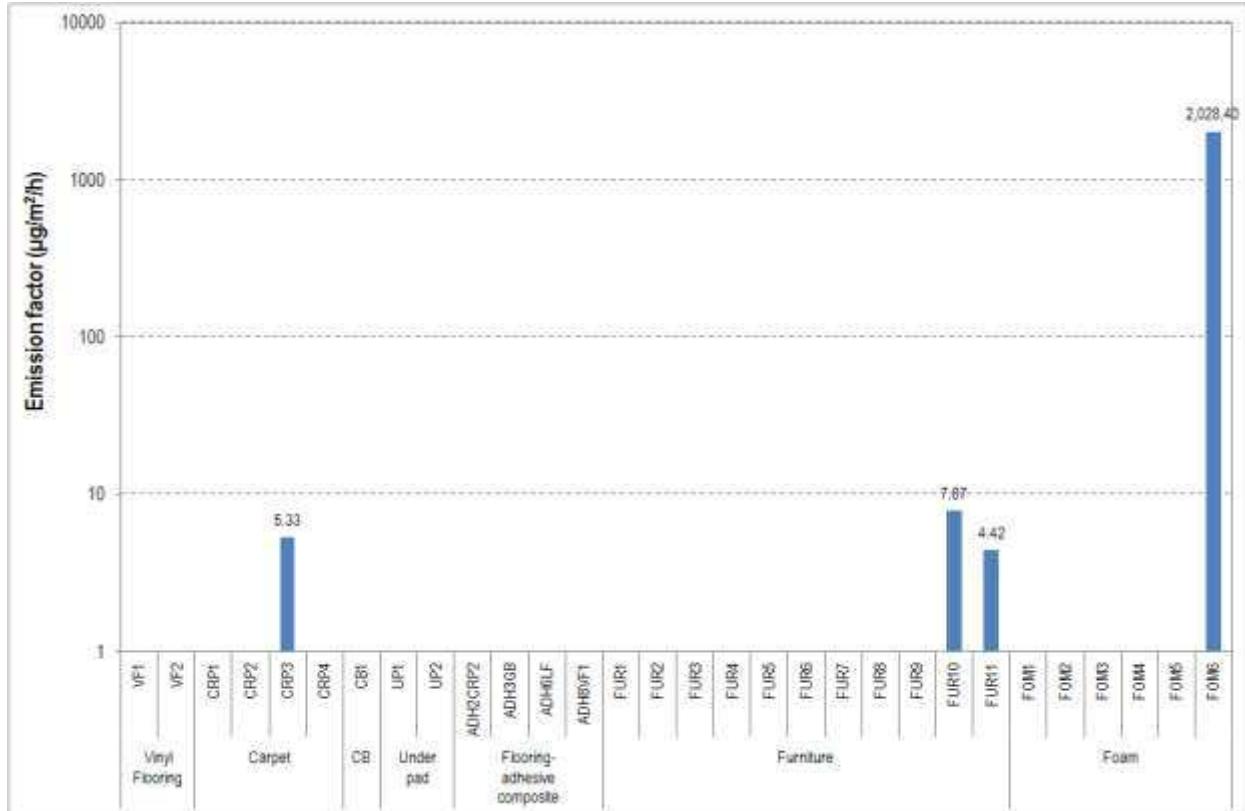


Figure A. 64: Emission factors for solid building materials and furnishings (#22: hexadecane)

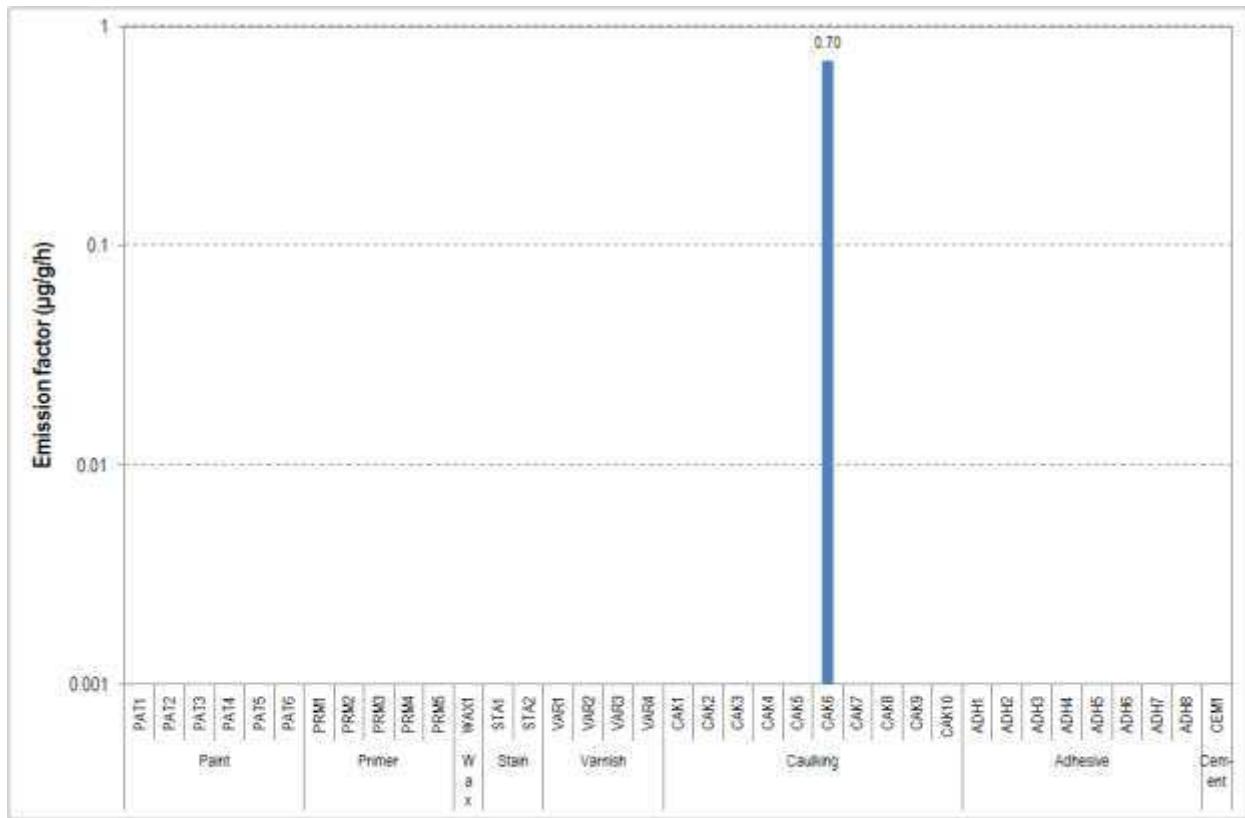


Figure A. 65: Emission factors for liquid building materials (#22: hexadecane)

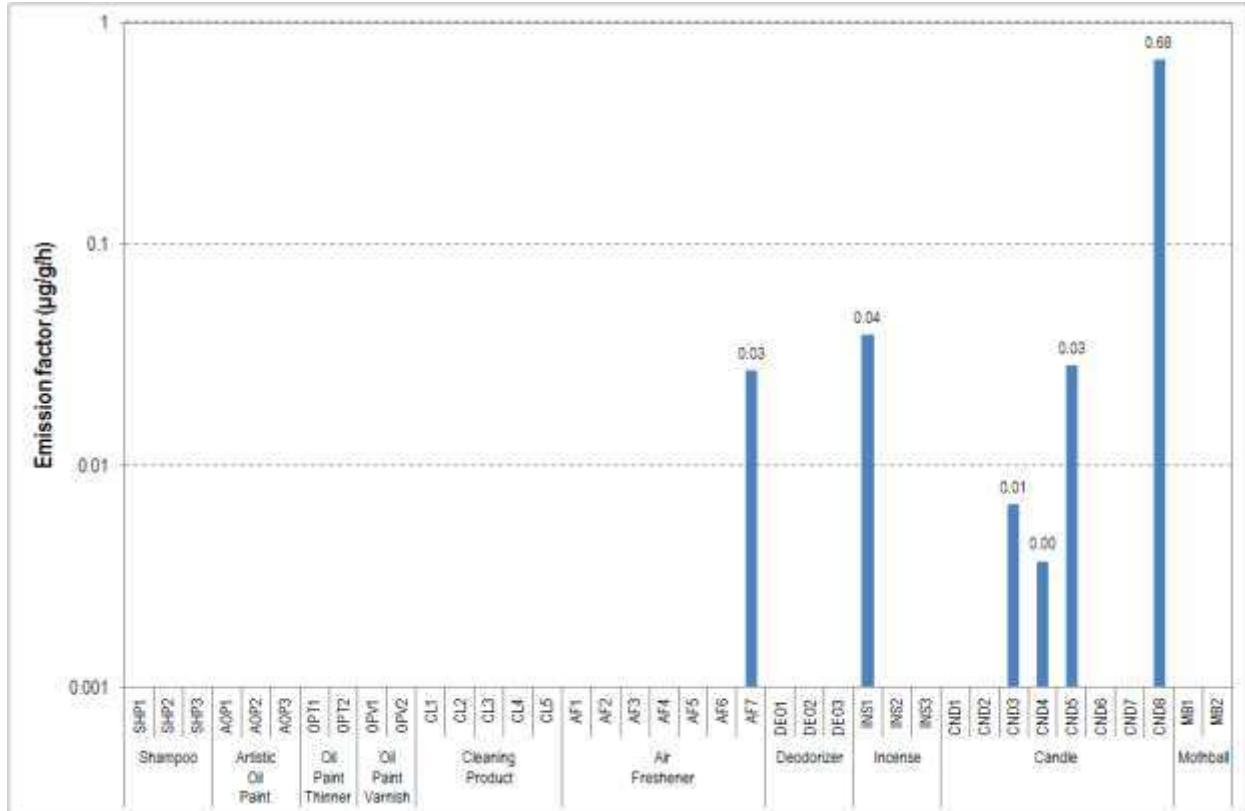


Figure A. 66: Emission factors for consumer/personal-care products (#22: hexadecane)

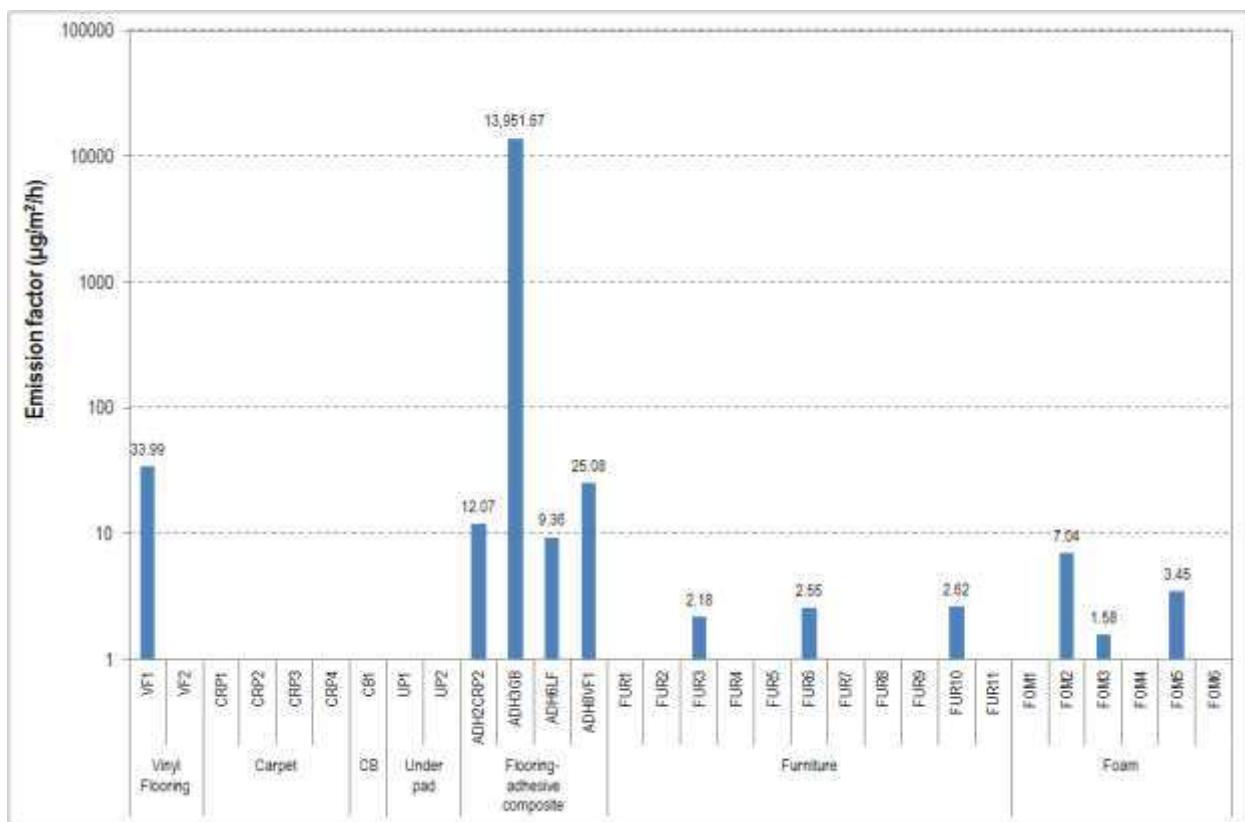


Figure A. 67: Emission factors for solid building materials and furnishings (#24: nonane)

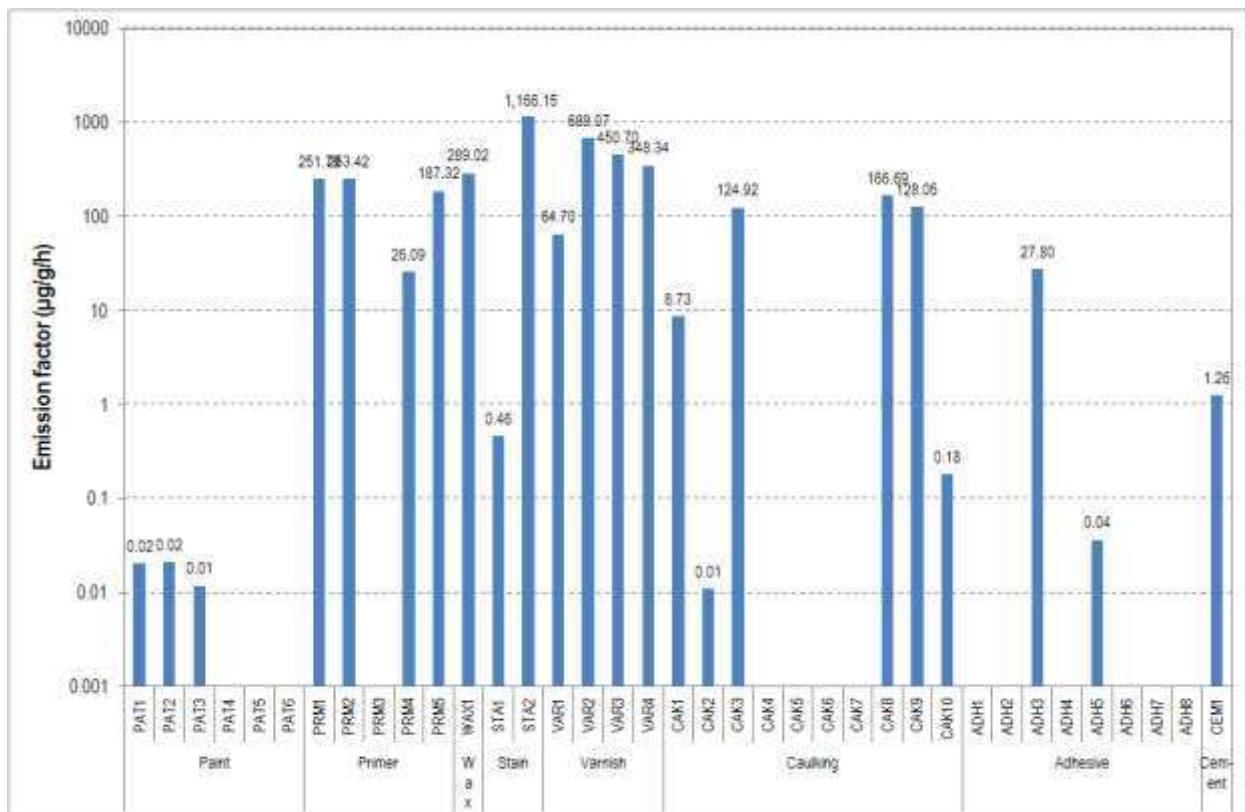


Figure A. 68: Emission factors for liquid building materials (#24: nonane)

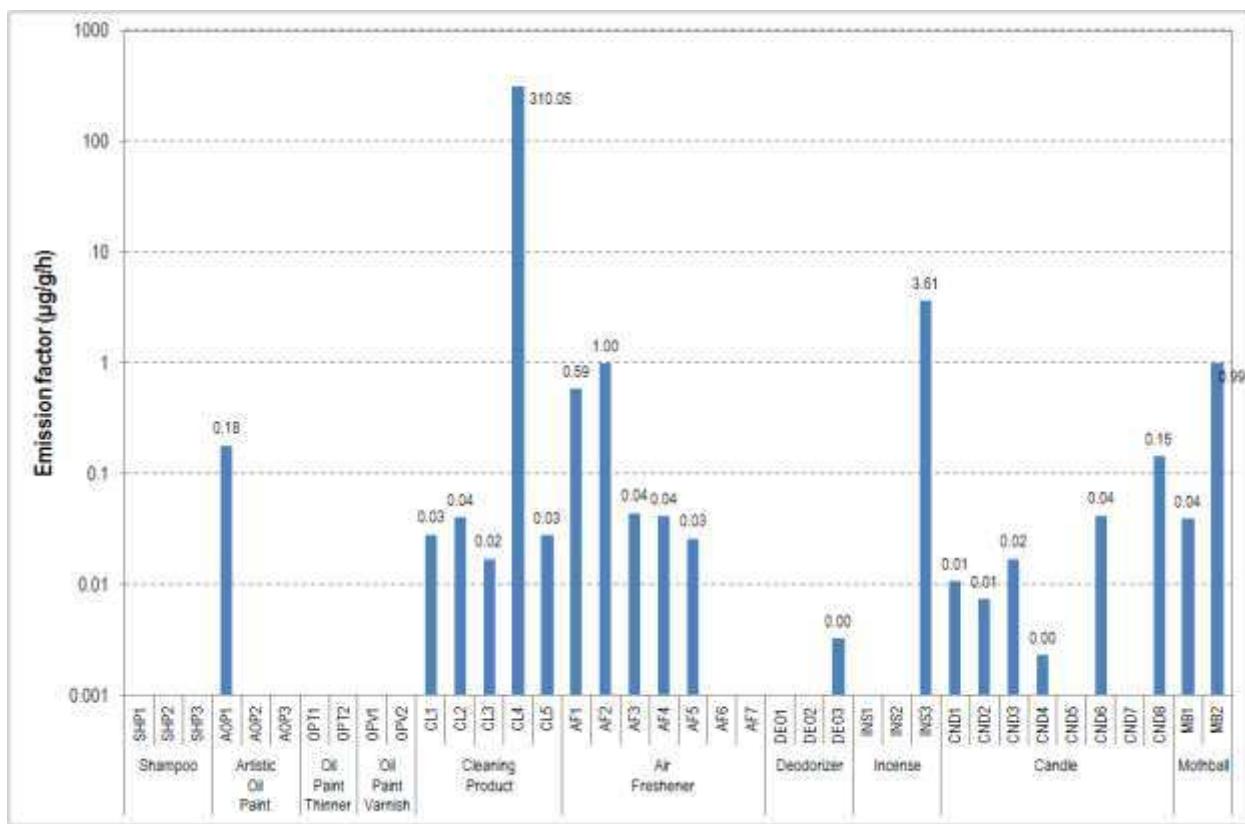


Figure A. 69: Emission factors for consumer/personal-care products (#24: nonane)

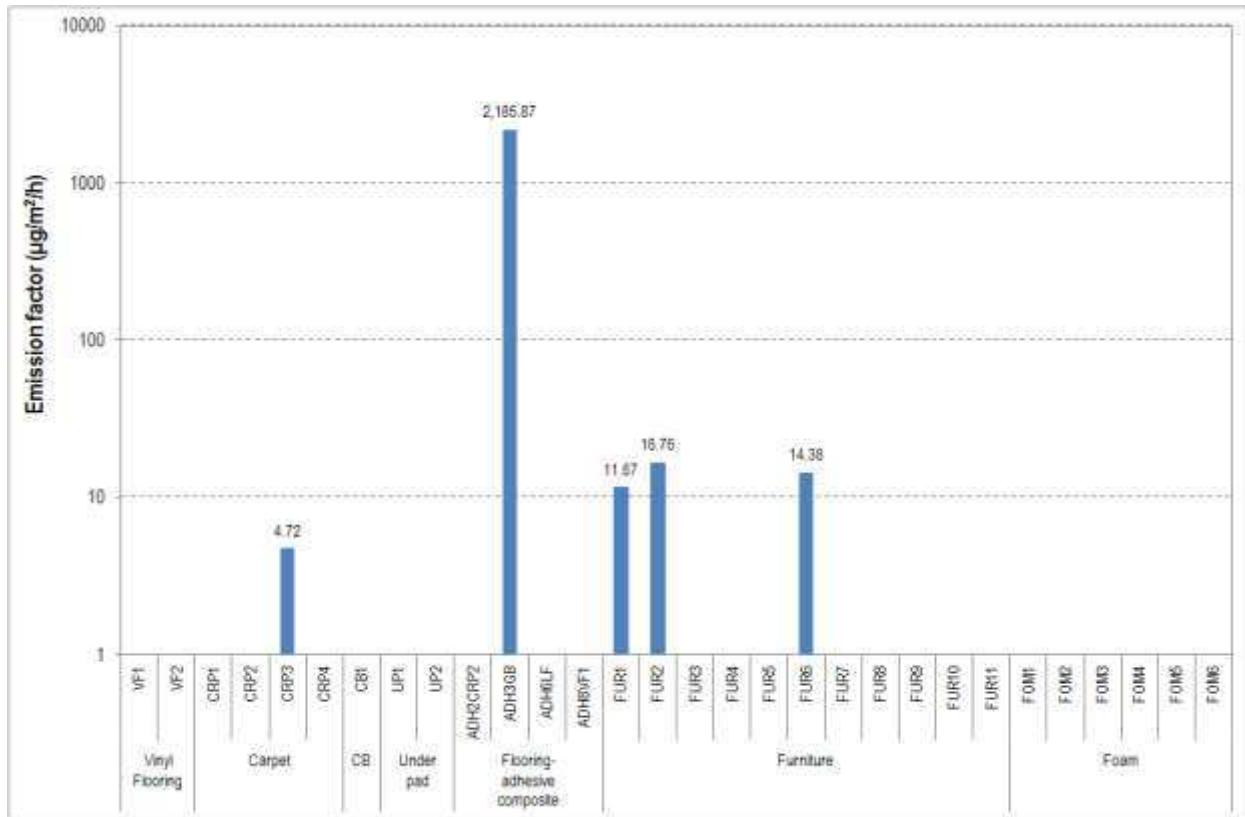


Figure A. 70: Emission factors for solid building materials and furnishings (#25: octane)

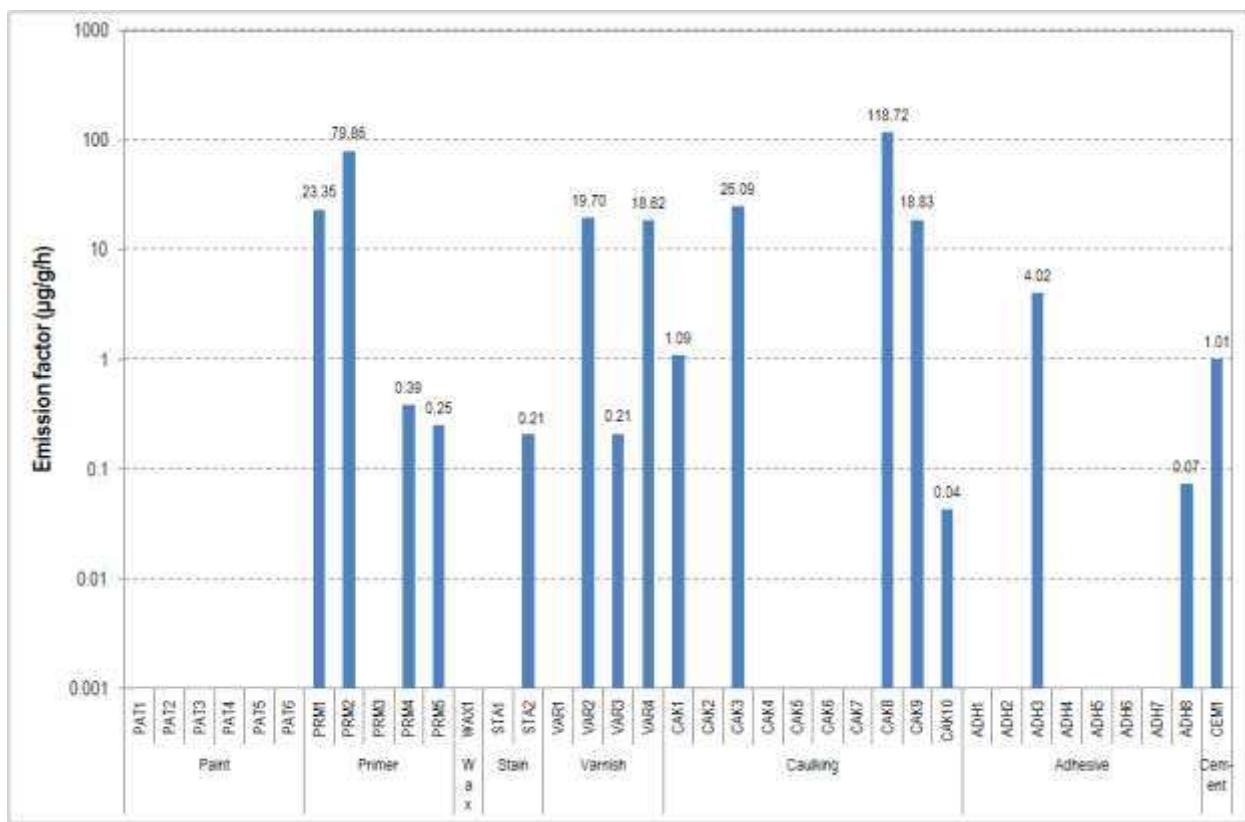


Figure A. 71: Emission factors for liquid building materials (#25: octane)

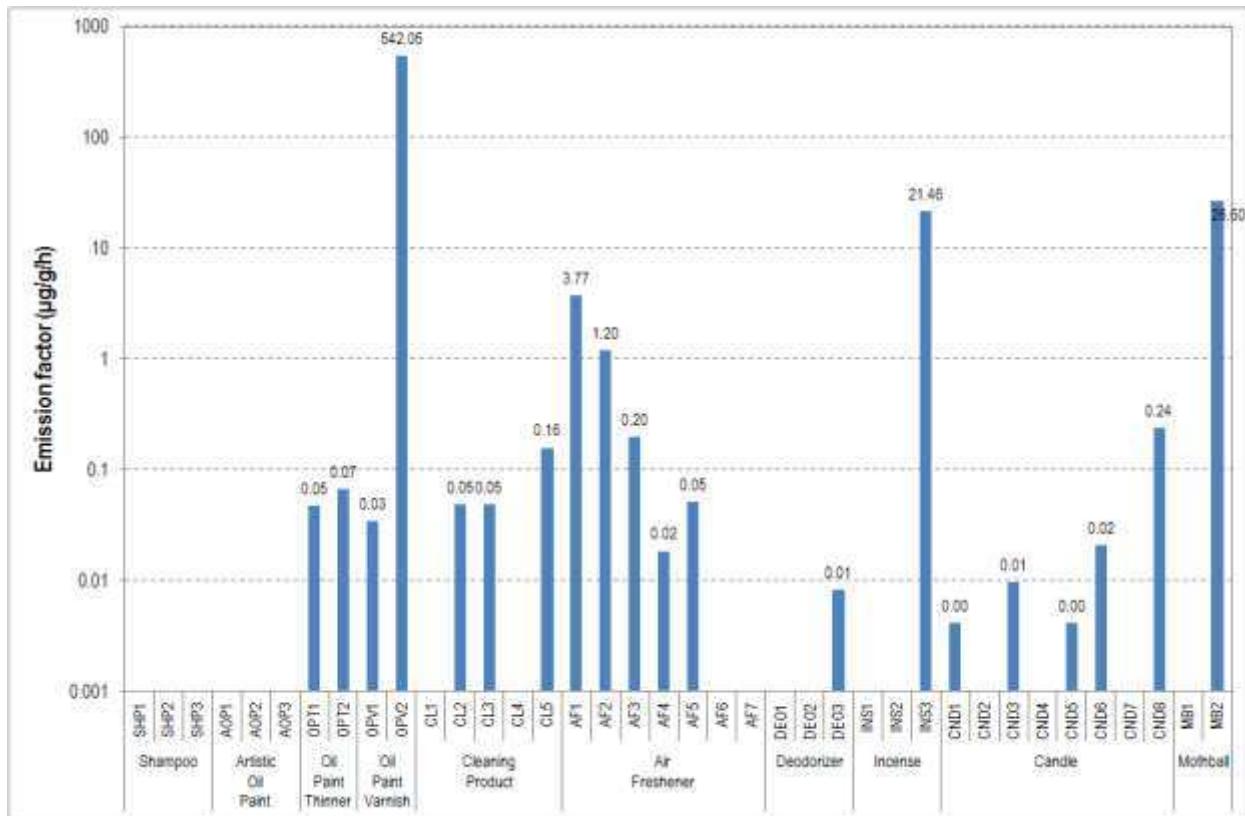


Figure A. 72: Emission factors for consumer/personal-care products (#25: octane)

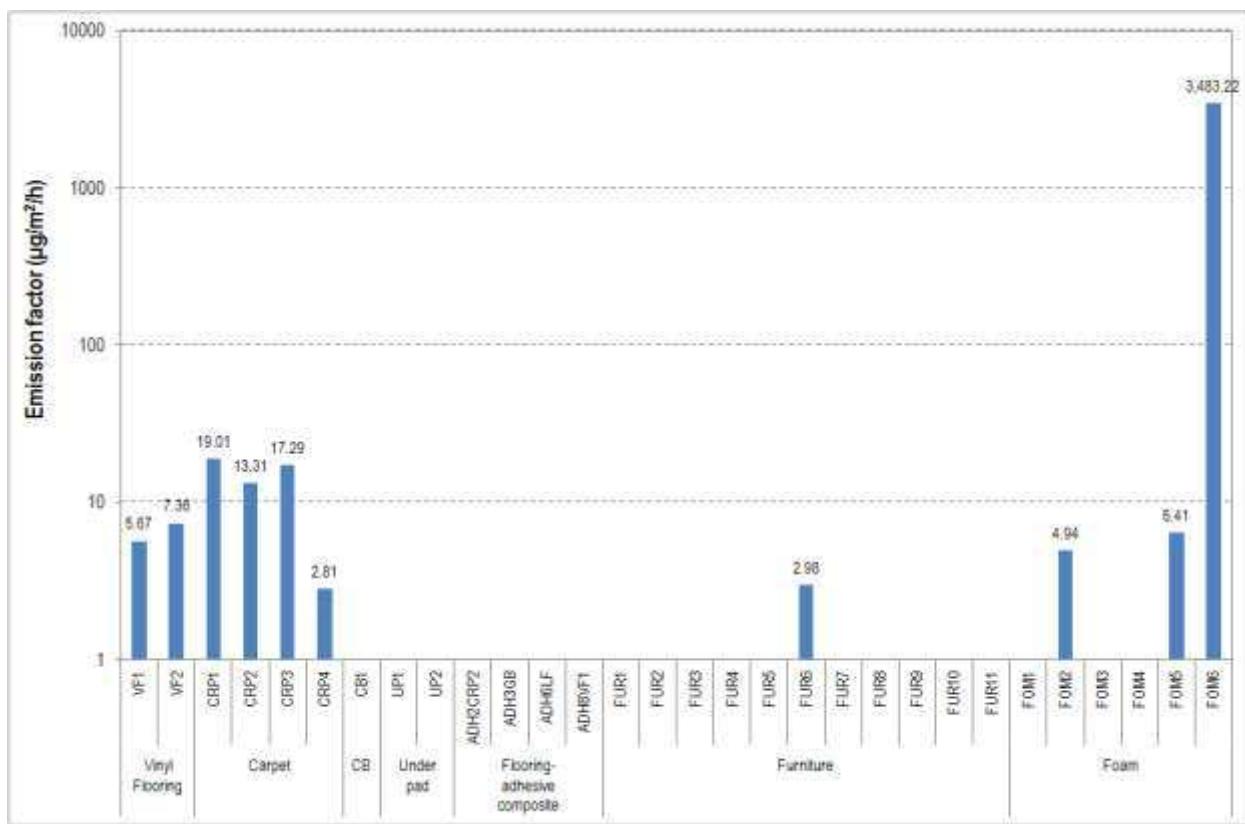


Figure A. 73: Emission factors for solid building materials and furnishings (#26: pentadecane)

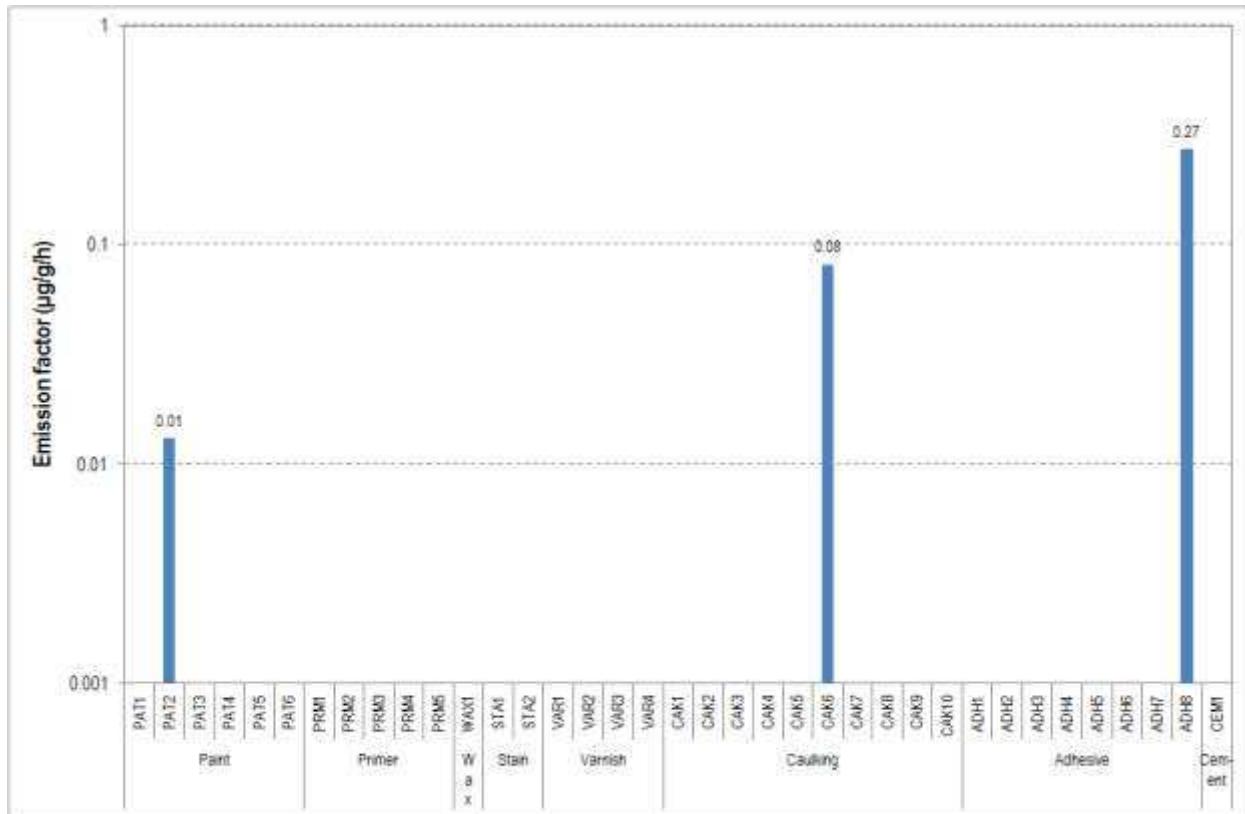


Figure A. 74: Emission factors for liquid building materials (#26: pentadecane)

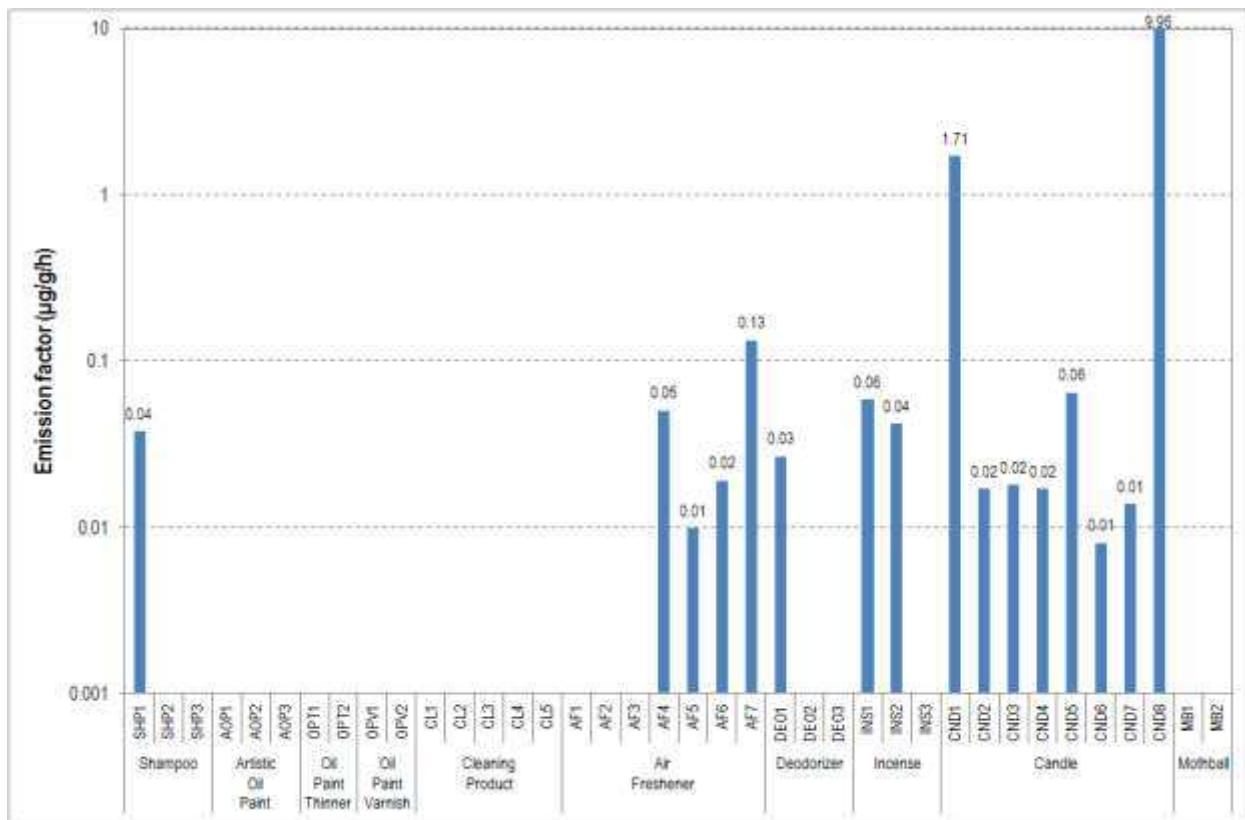


Figure A. 75: Emission factors for consumer/personal-care products (#26: pentadecane)

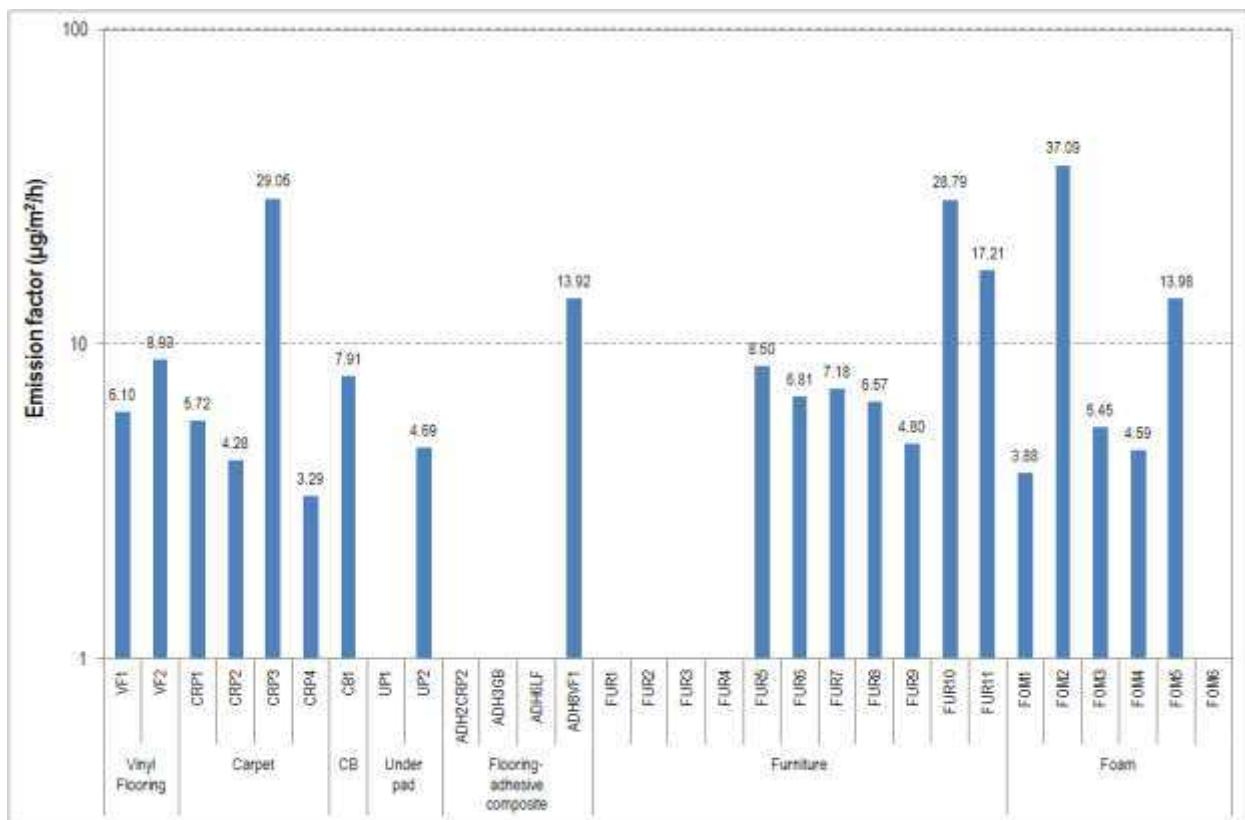


Figure A. 76: Emission factors for solid building materials and furnishings (#27: tetradecane)

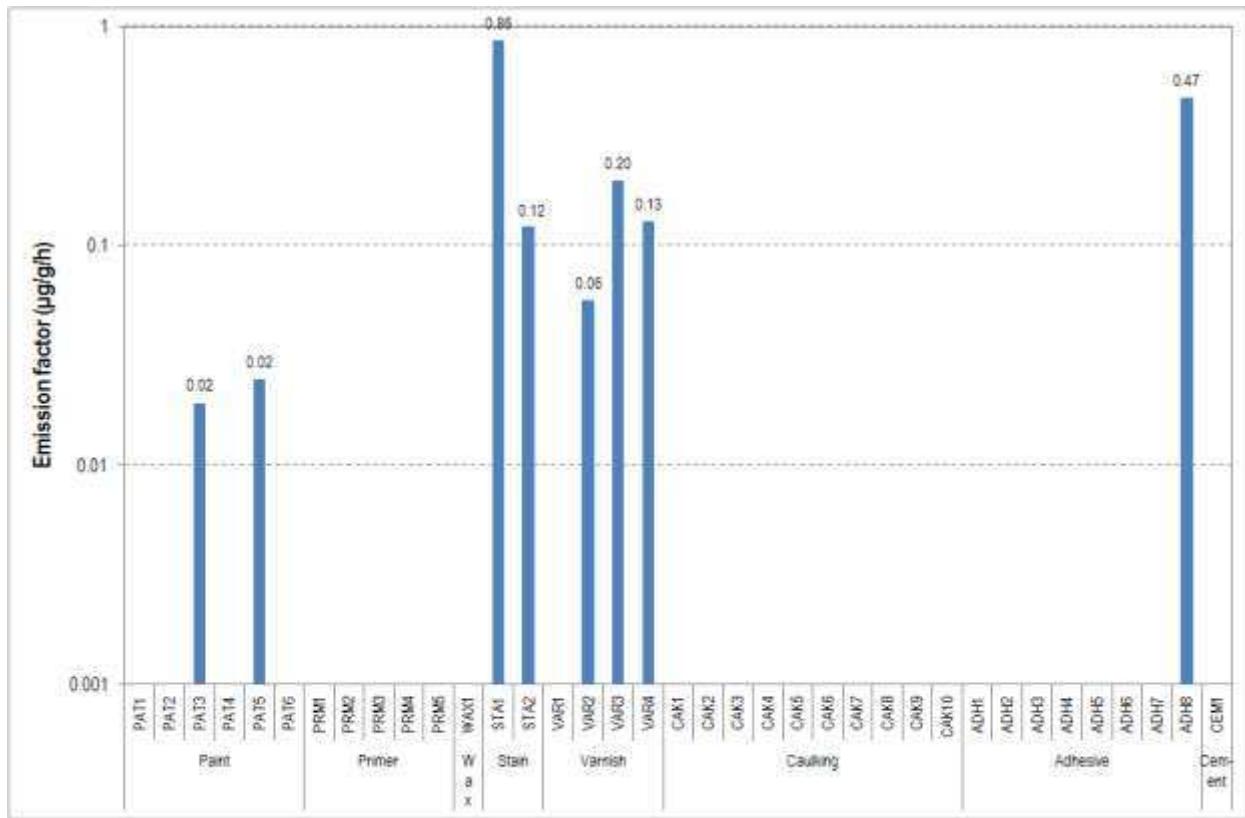


Figure A. 77: Emission factors for liquid building materials (#27: tetradecone)

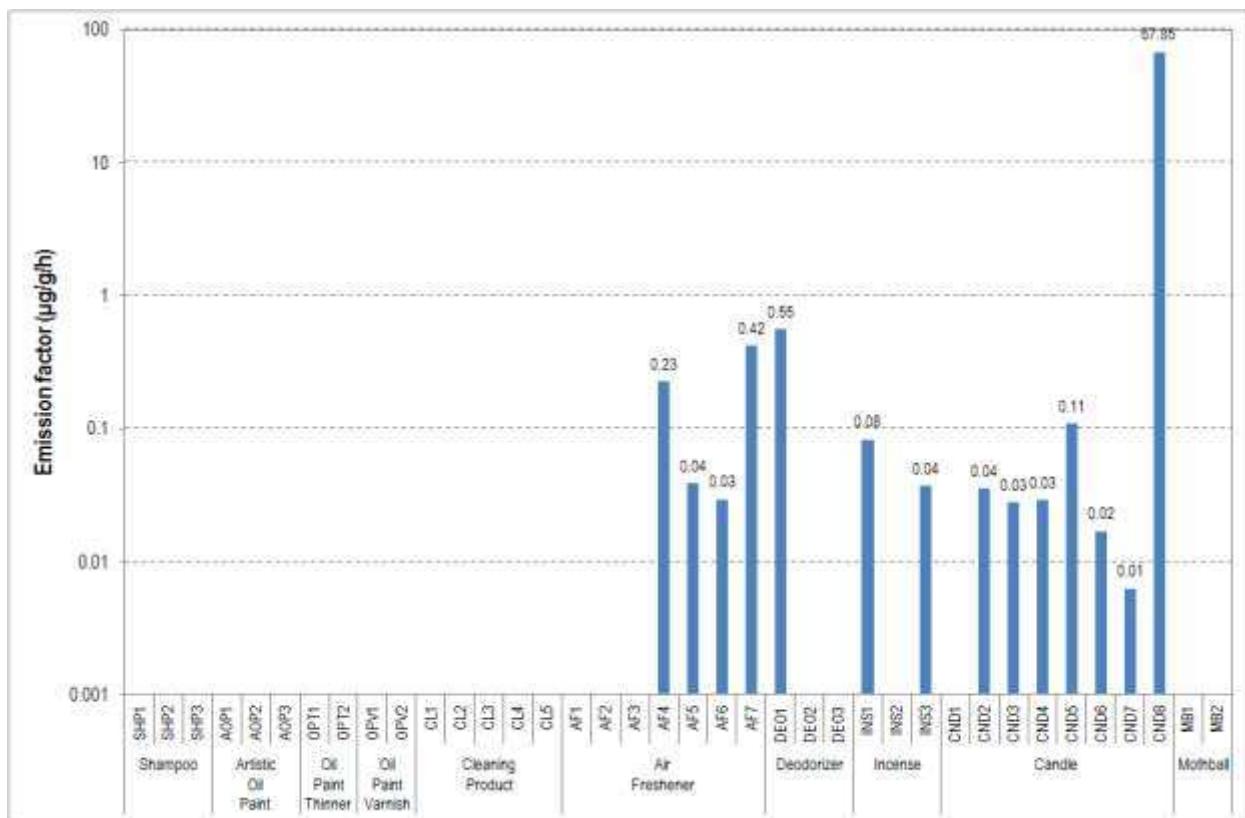


Figure A. 78: Emission factors for consumer/personal-care products (#27: tetradecone)

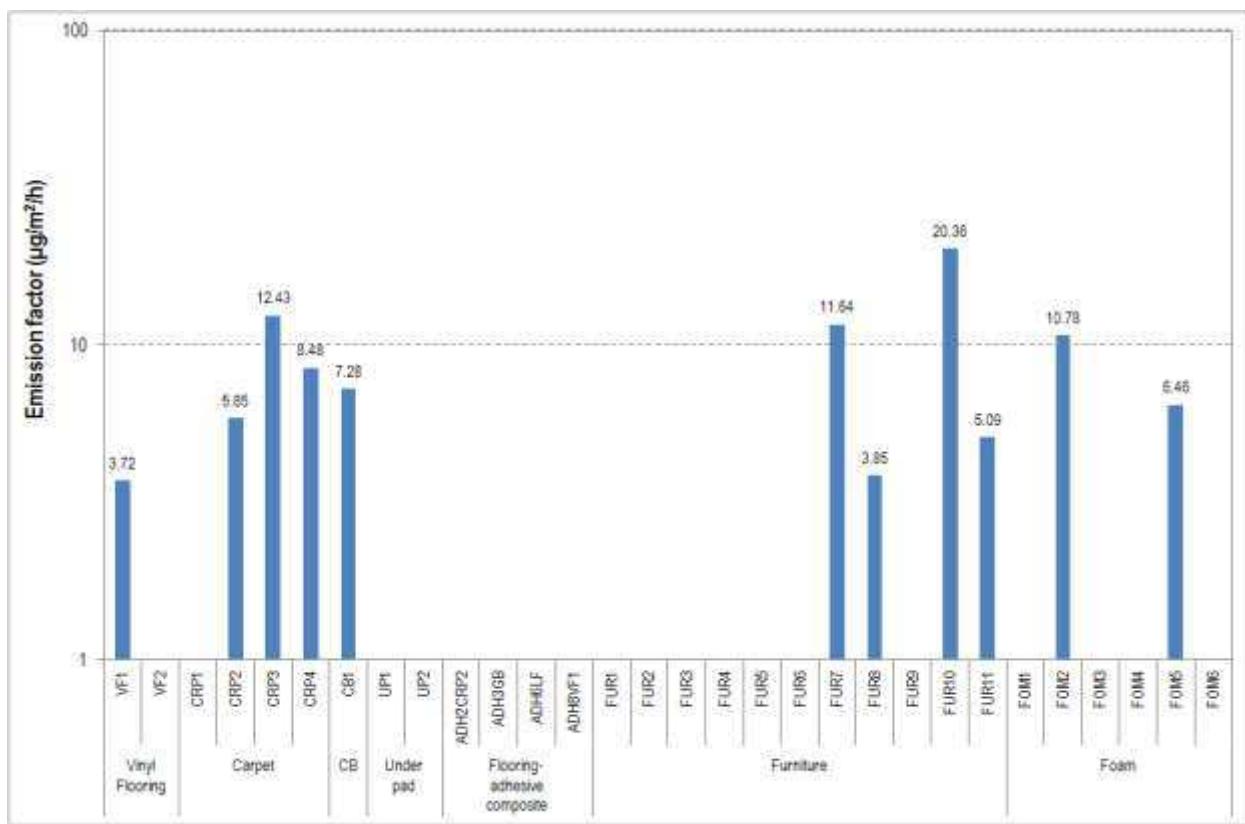


Figure A. 79: Emission factors for solid building materials and furnishings (#28: tridecane)

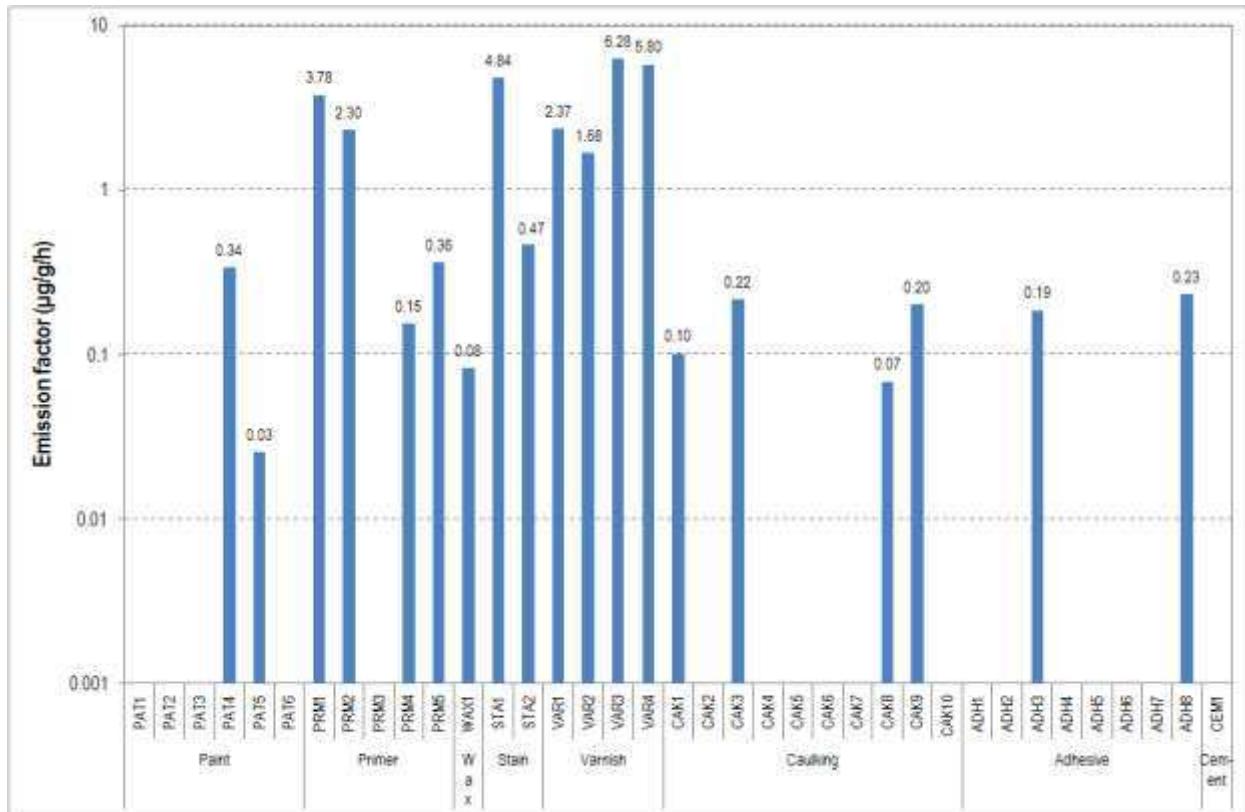


Figure A. 80: Emission factors for liquid building materials (#28: tridecane)

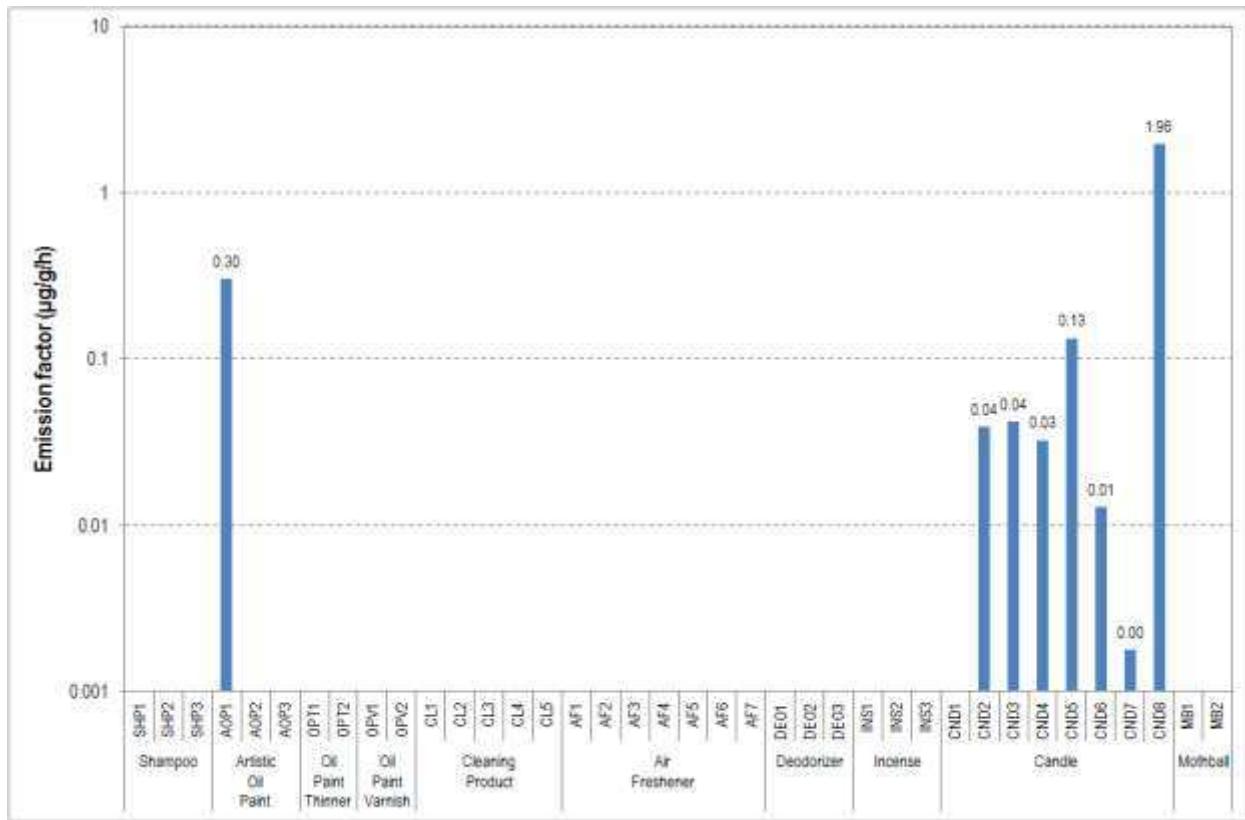


Figure A. 81: Emission factors for consumer/personal-care products (#28: tridecane)

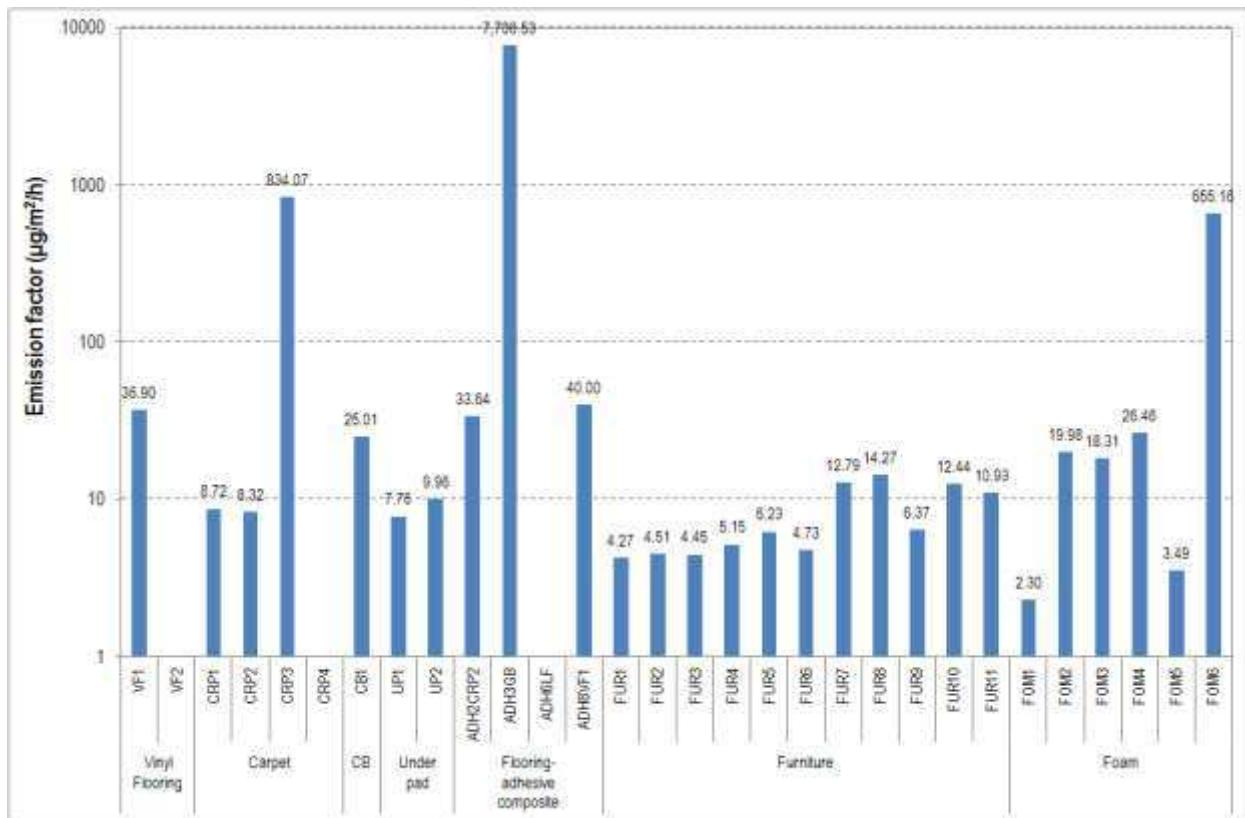


Figure A. 82: Emission factors for solid building materials and furnishings (#29: undecane)

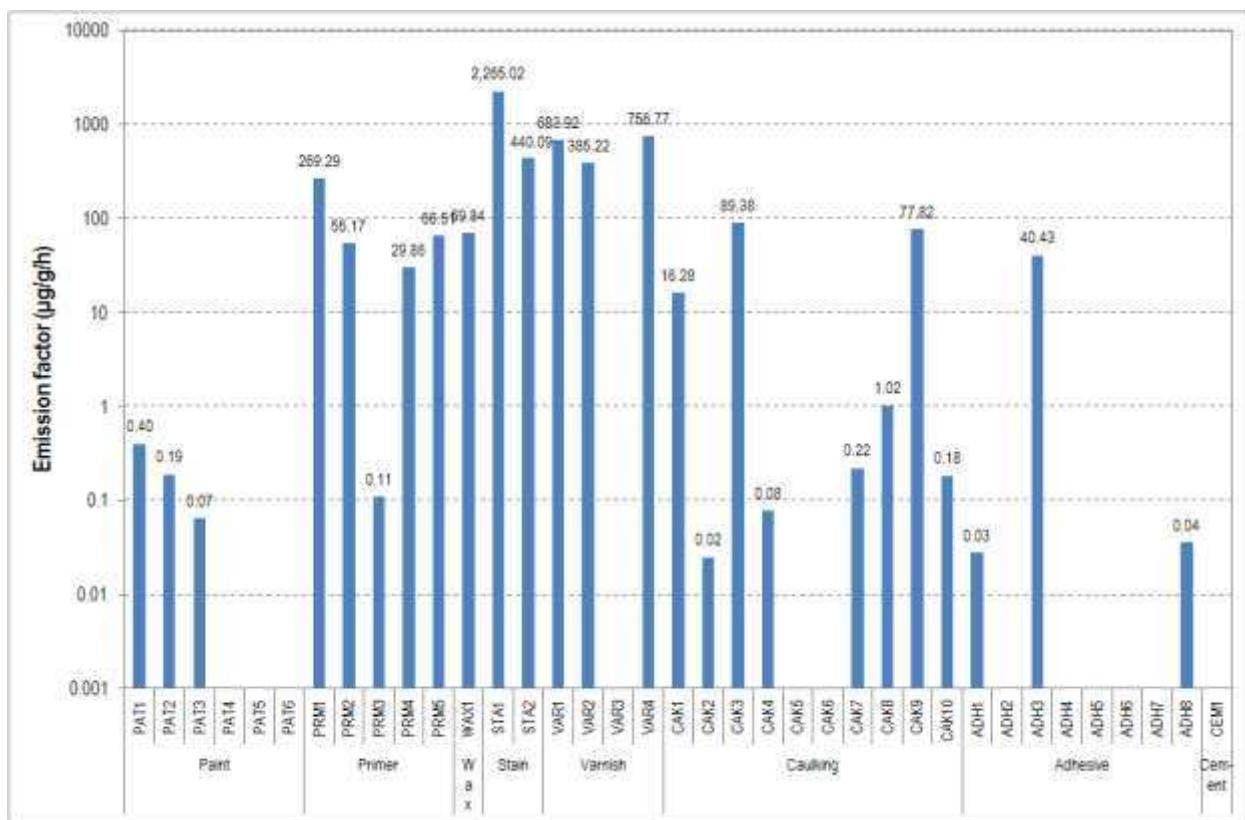


Figure A. 83: Emission factors for liquid building materials (#29: undecane)

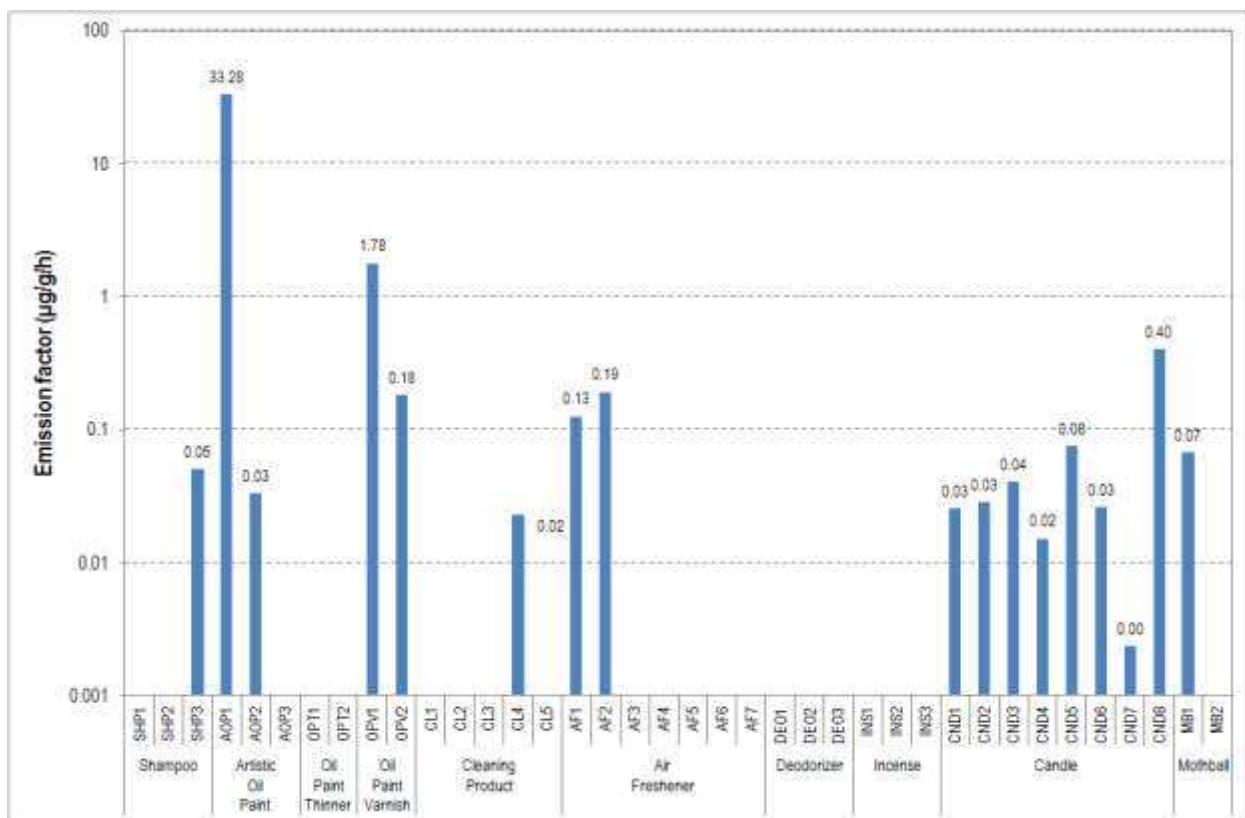


Figure A. 84: Emission factors for consumer/personal-care products (#29: undecane)

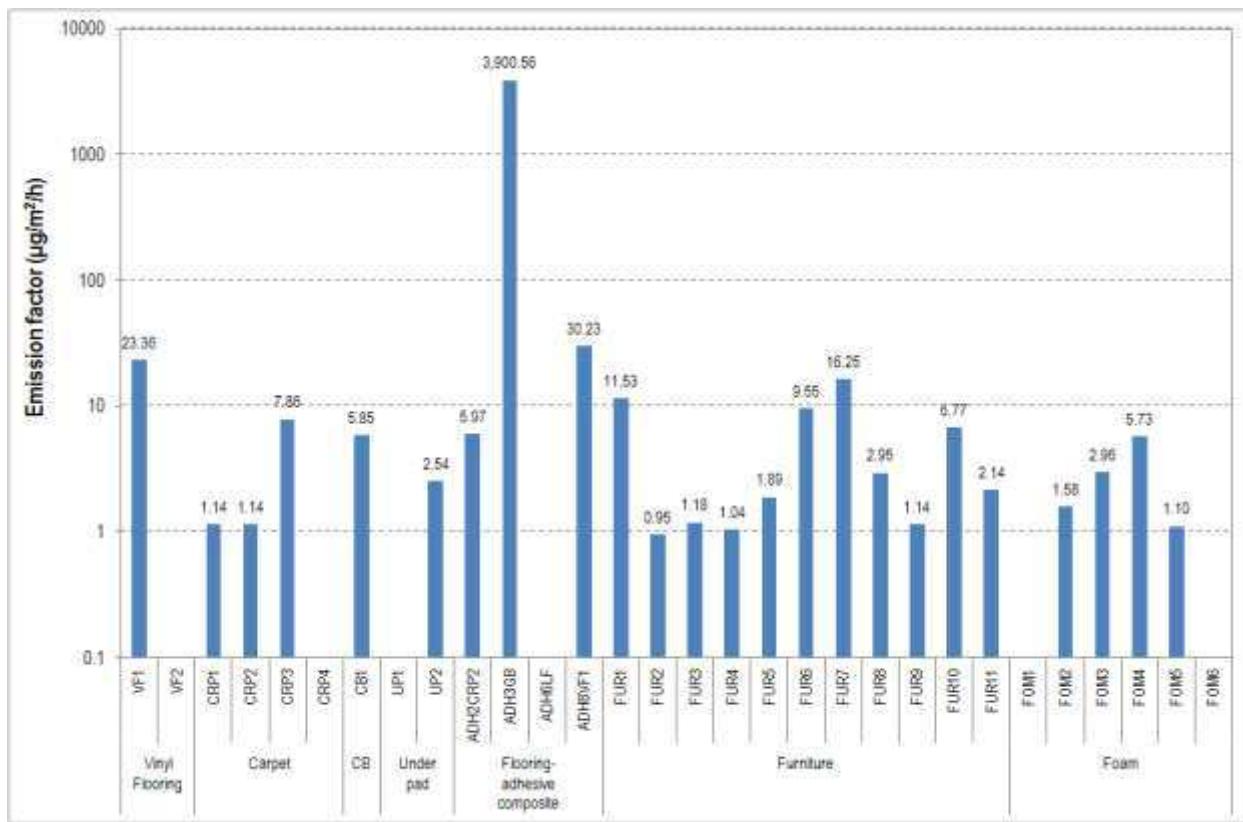


Figure A. 85: Emission factors for solid building materials and furnishings (#32: 1,2,3-trimethylbenzene)

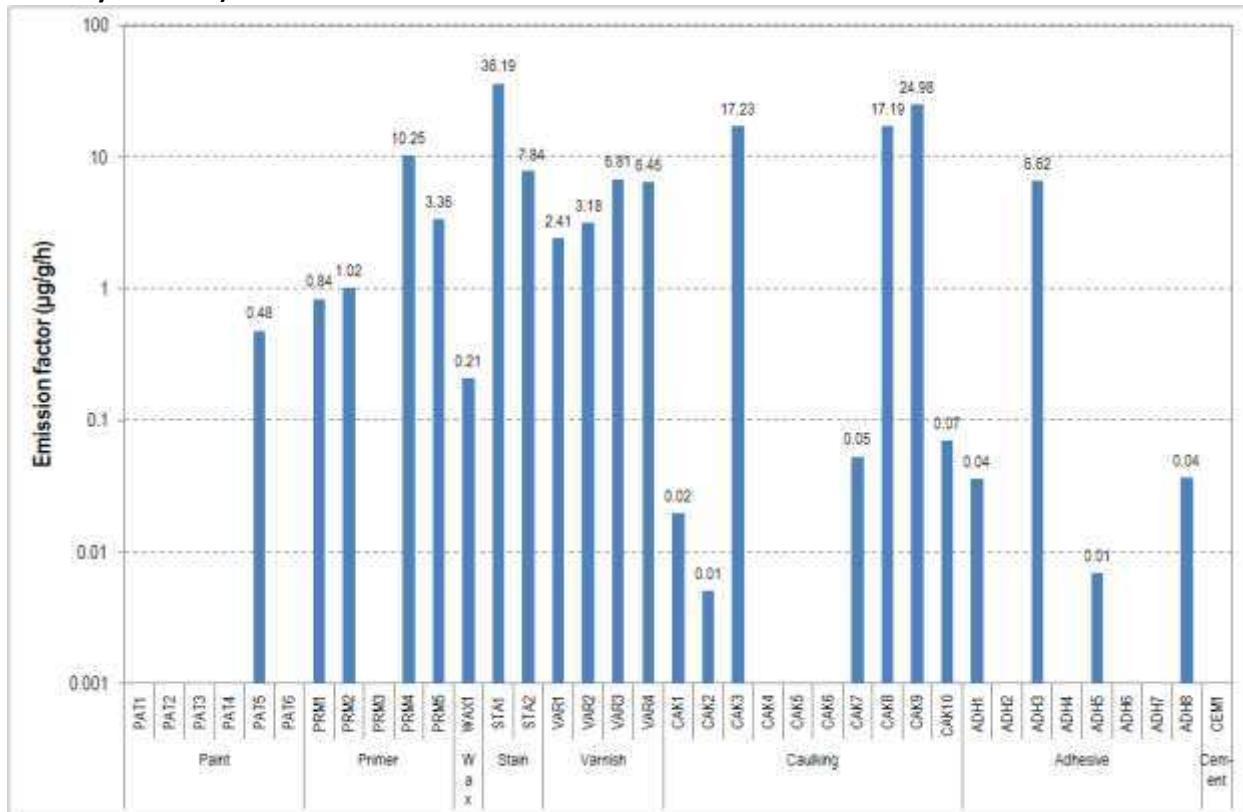


Figure A. 86: Emission factors for liquid building materials (#32: 1,2,3-trimethylbenzene)

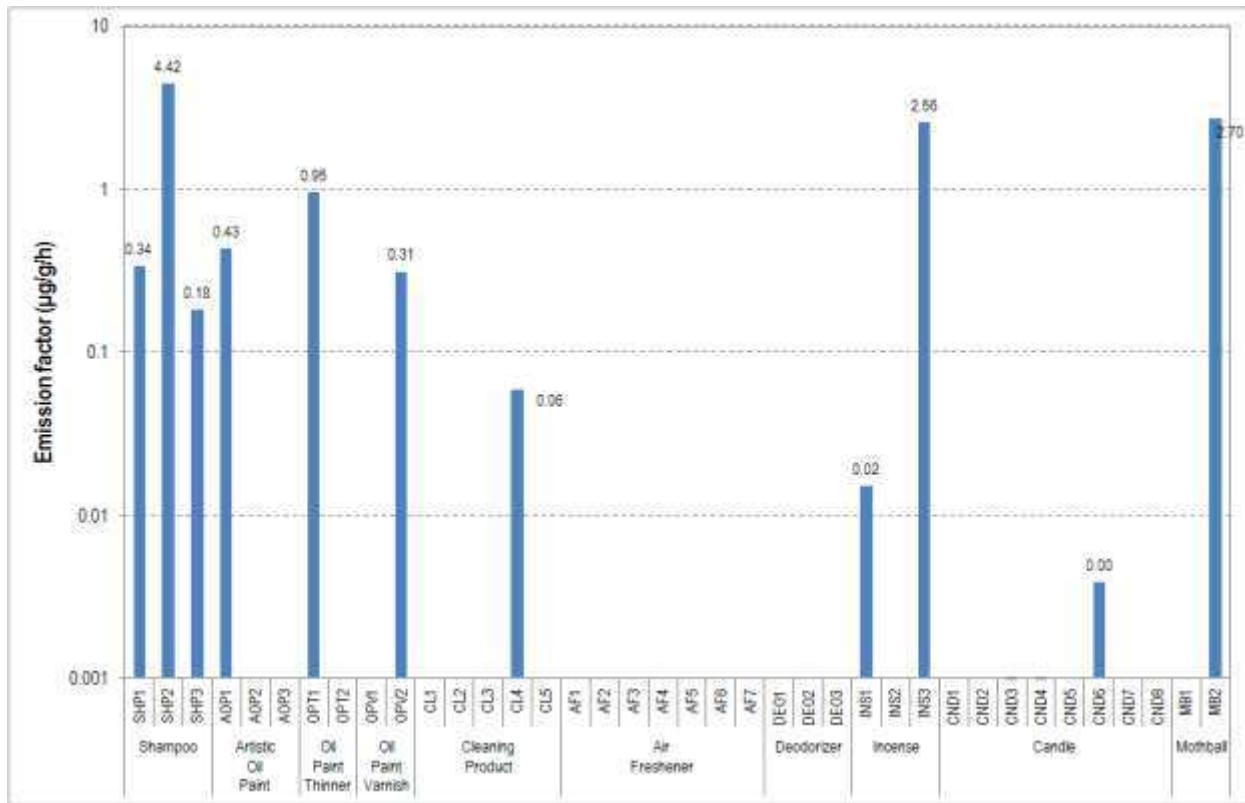


Figure A. 87: Emission factors for consumer/personal-care products (#32: 1,2,3-trimethylbenzene)

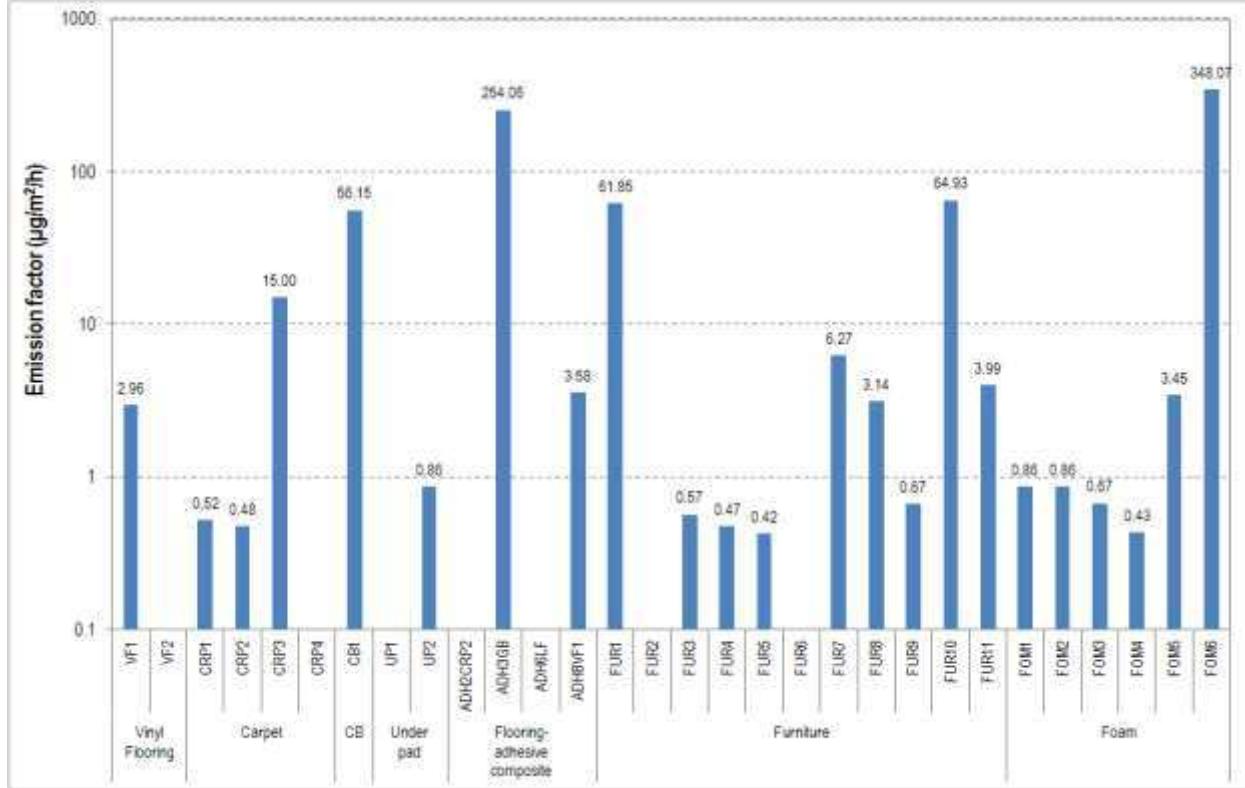


Figure A. 88: Emission factors for solid building materials and furnishings (#33: 1,2,4,5-tetramethylbenzene)

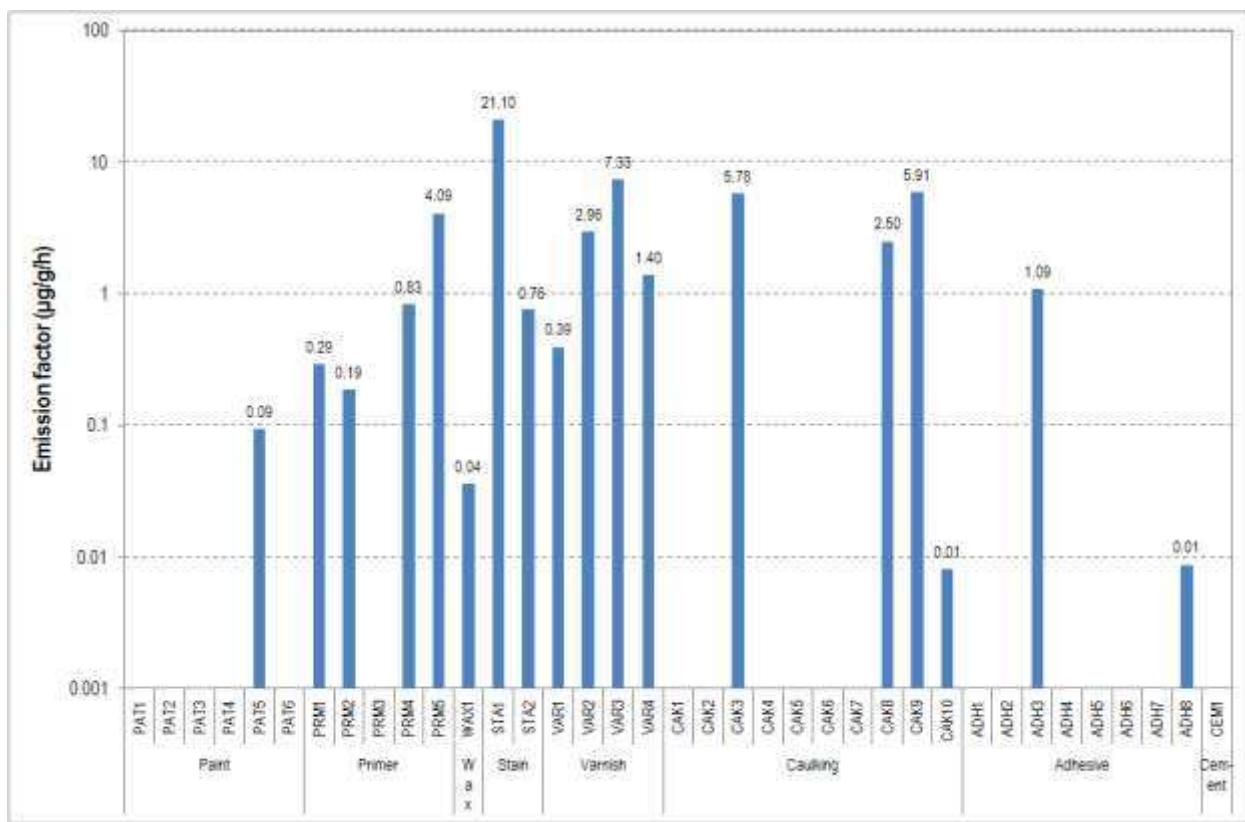


Figure A. 89: Emission factors for liquid building materials (#33: 1,2,4,5-tetramethylbenzene)

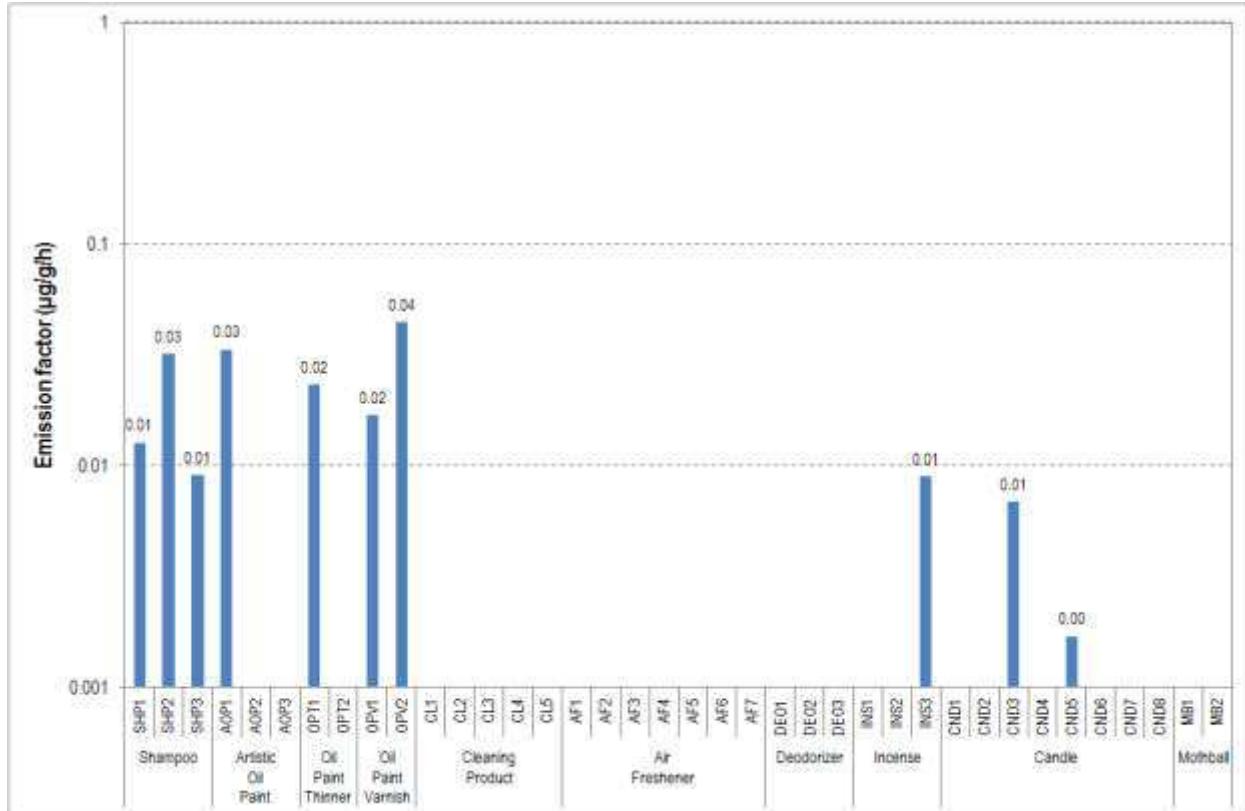


Figure A. 90: Emission factors for consumer/personal-care products (#33: 1,2,4,5-tetramethylbenzene)

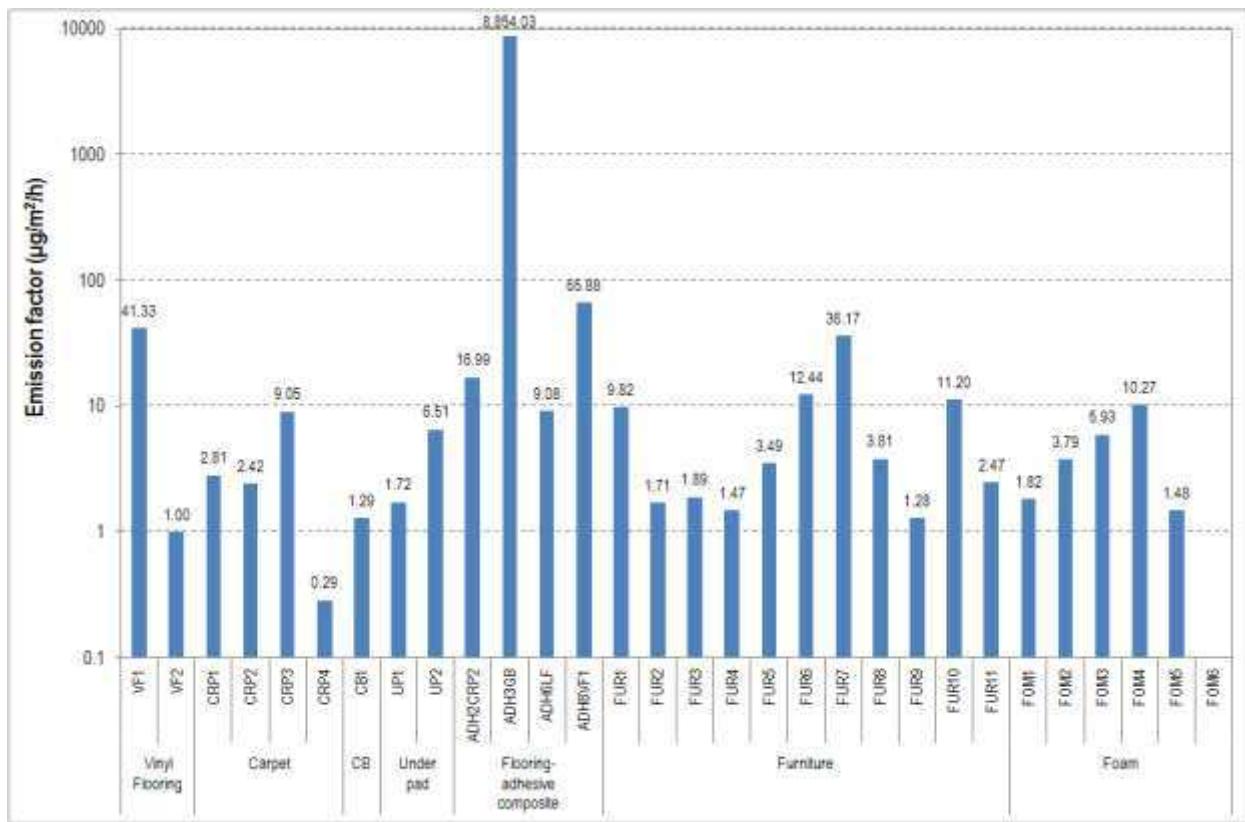


Figure A. 91: Emission factors for solid building materials and furnishings (#34: 1,2,4-trimethylbenzene)

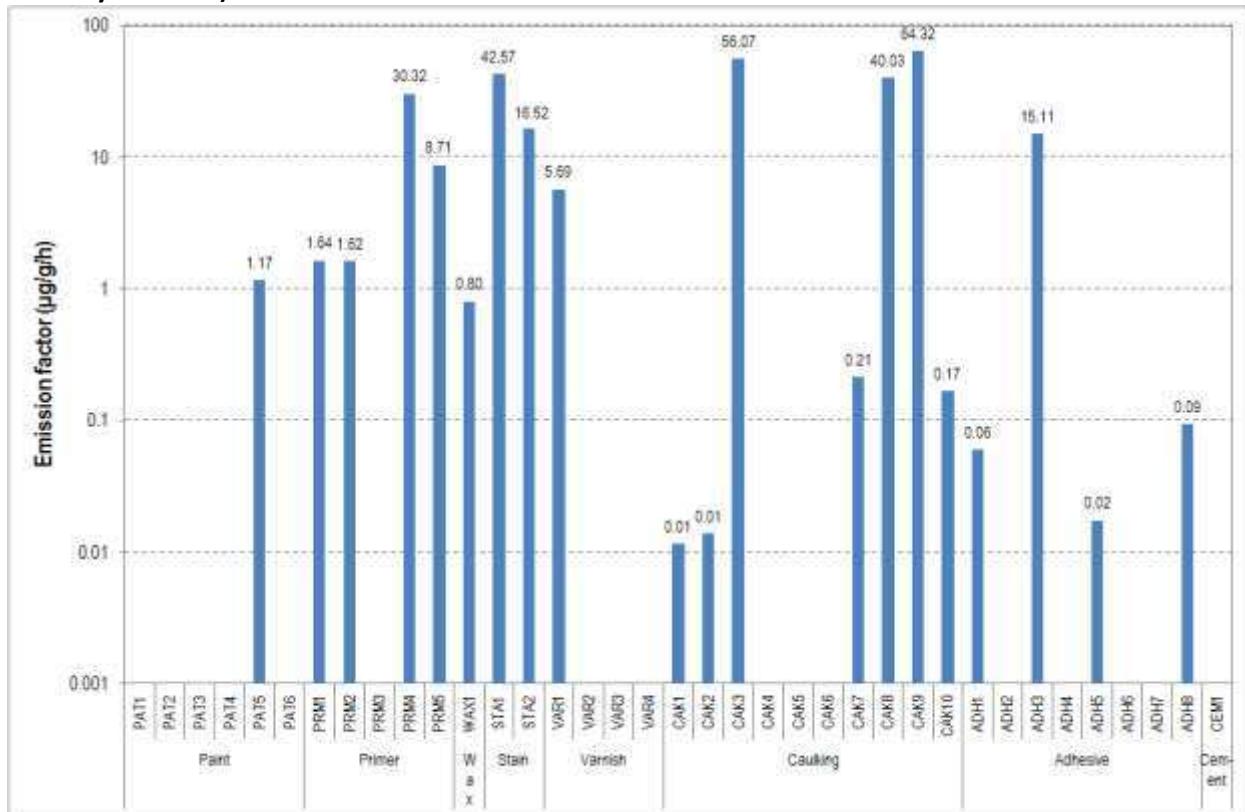


Figure A. 92: Emission factors for liquid building materials (#34: 1,2,4-trimethylbenzene)

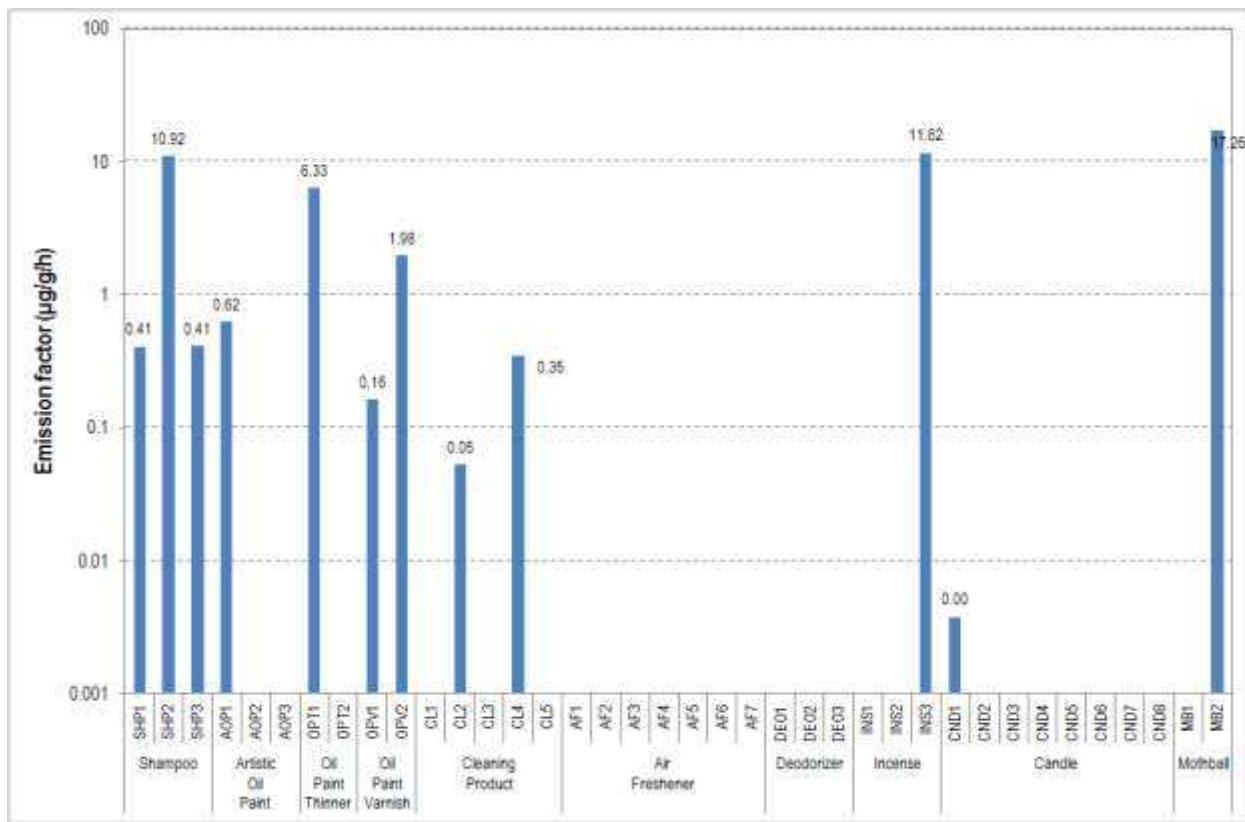


Figure A. 93: Emission factors for consumer/personal-care (#34: 1,2,4-trimethylbenzene)

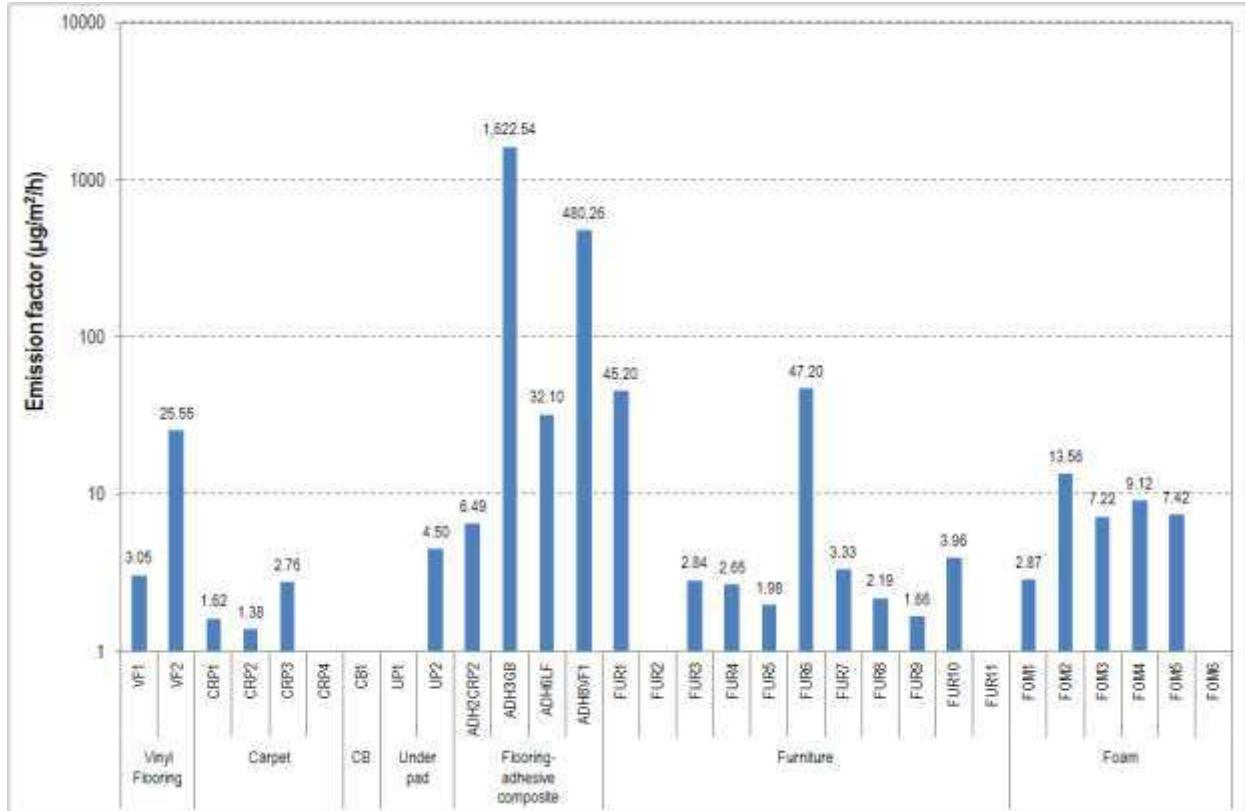


Figure A. 94: Emission factors for solid building materials and furnishings (#35: 1,2-dimethylbenzene)

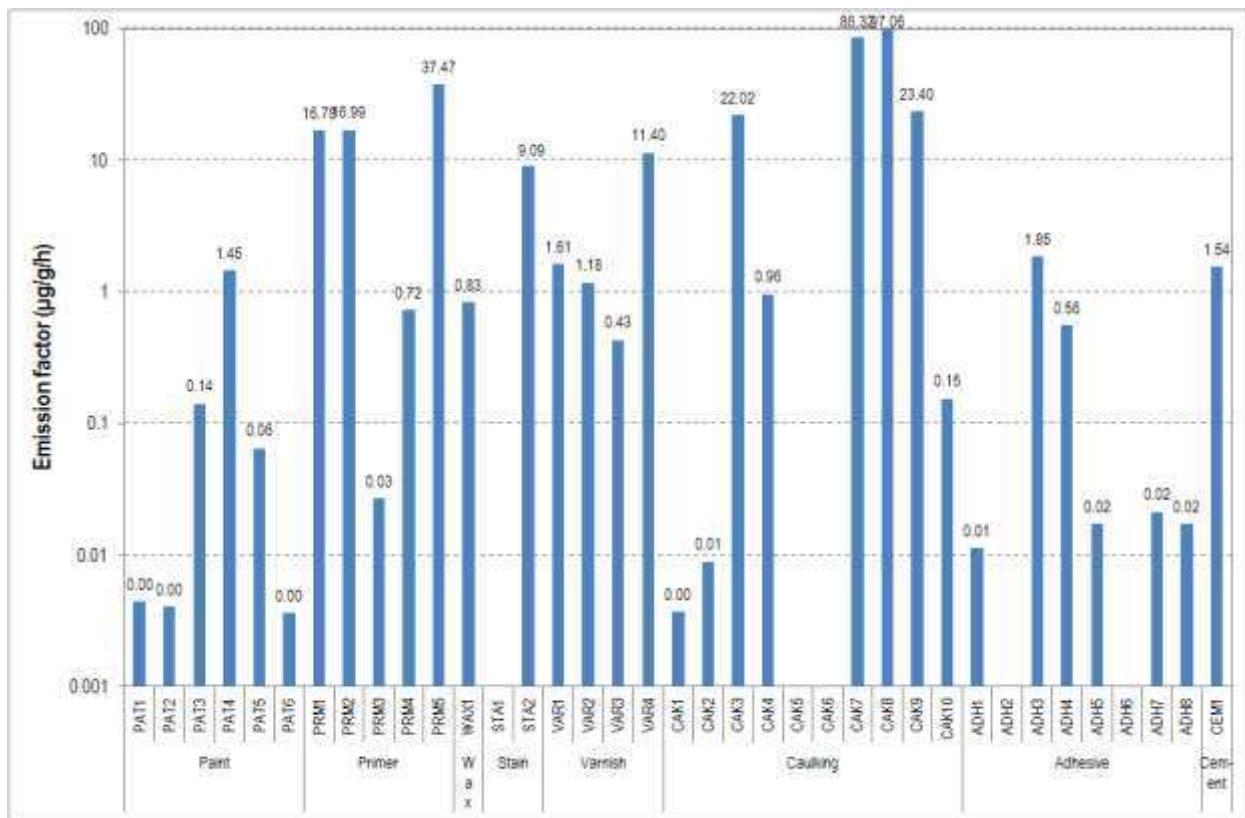


Figure A. 95: Emission factors for liquid building materials (#35: 1,2-dimethylbenzene)

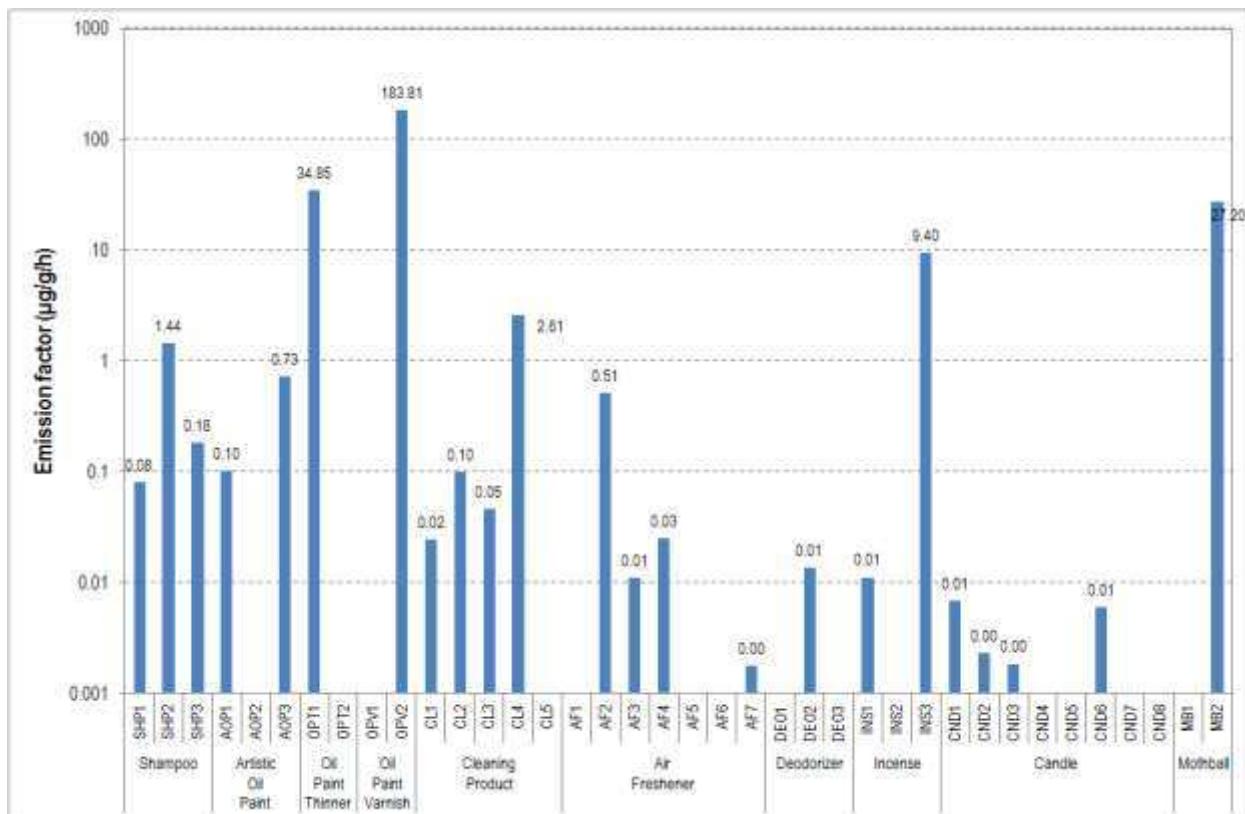


Figure A. 96: Emission factors for consumer/personal-care products (#35: 1,2-dimethylbenzene)

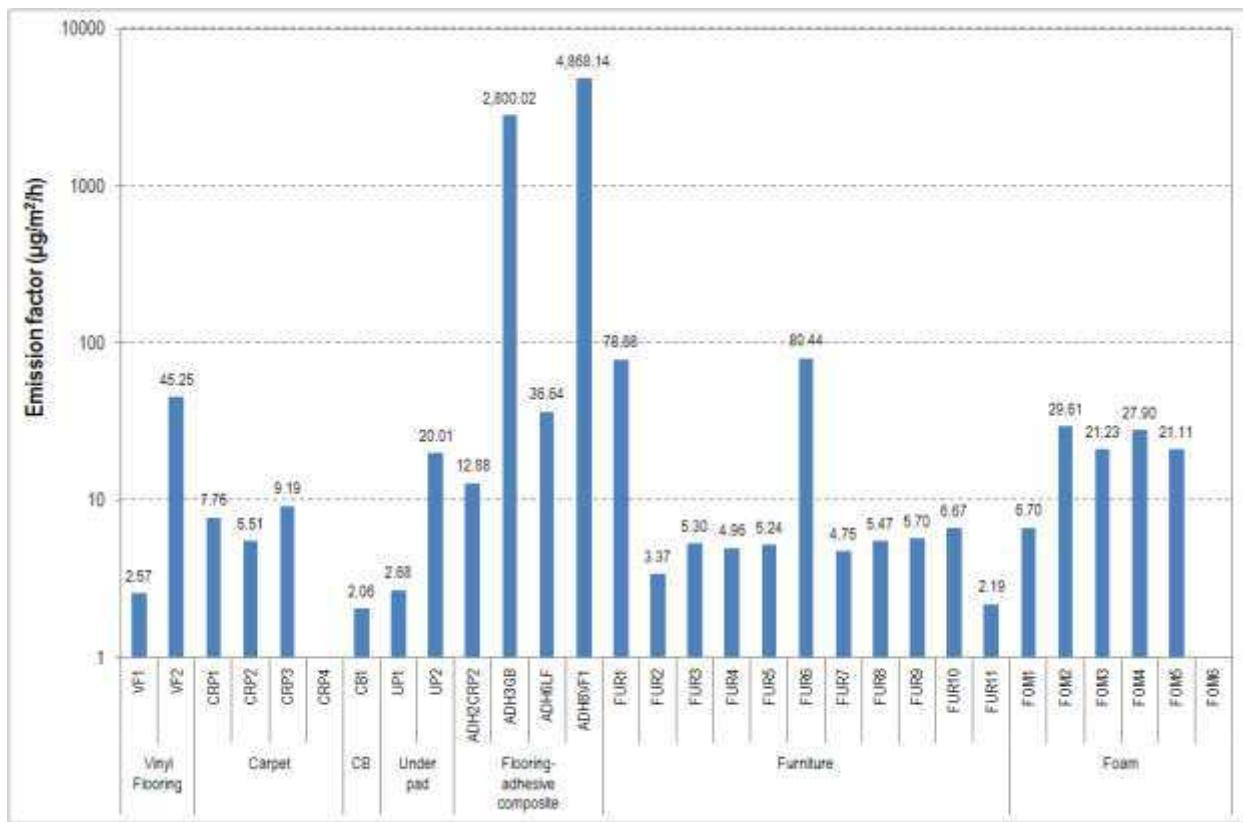


Figure A. 97: Emission factors for solid building materials and furnishings (#36: 1,3(4)-dimethylbenzene)

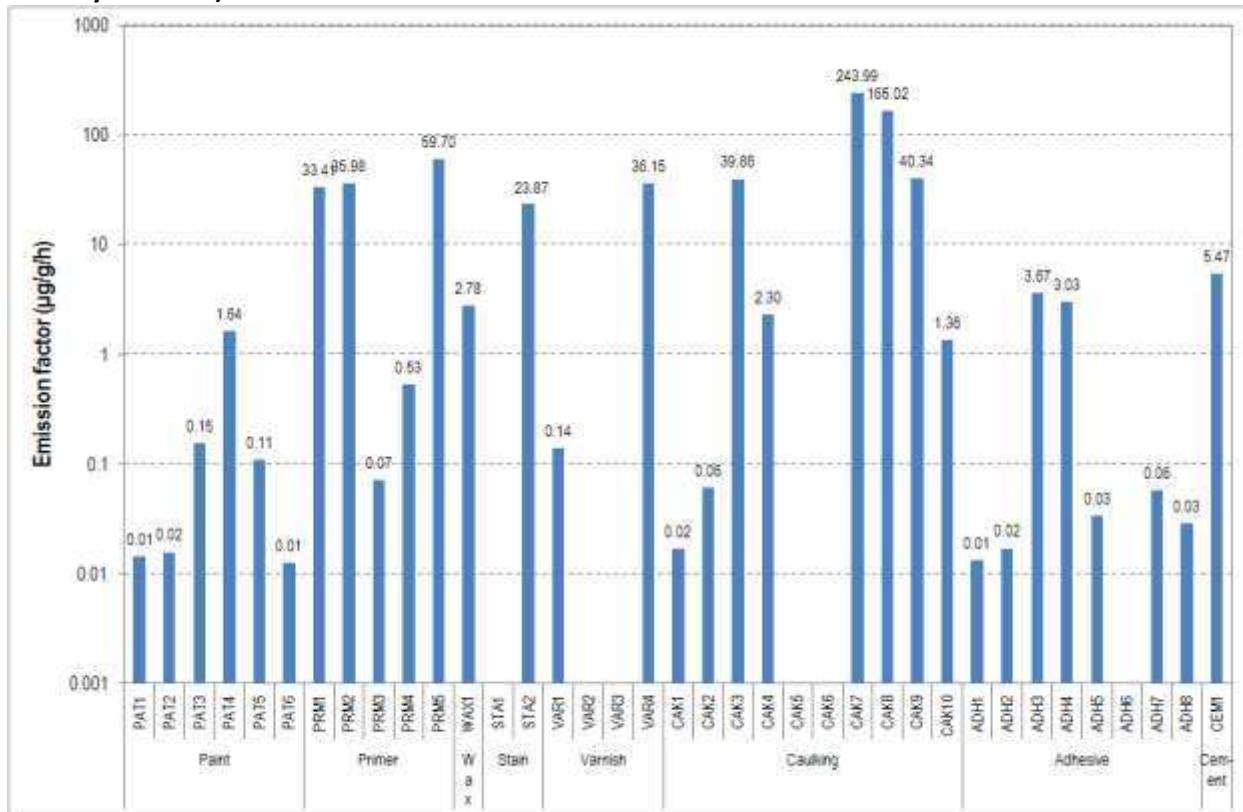


Figure A. 98: Emission factors for liquid building materials (#36: 1,3(4)-dimethylbenzene)

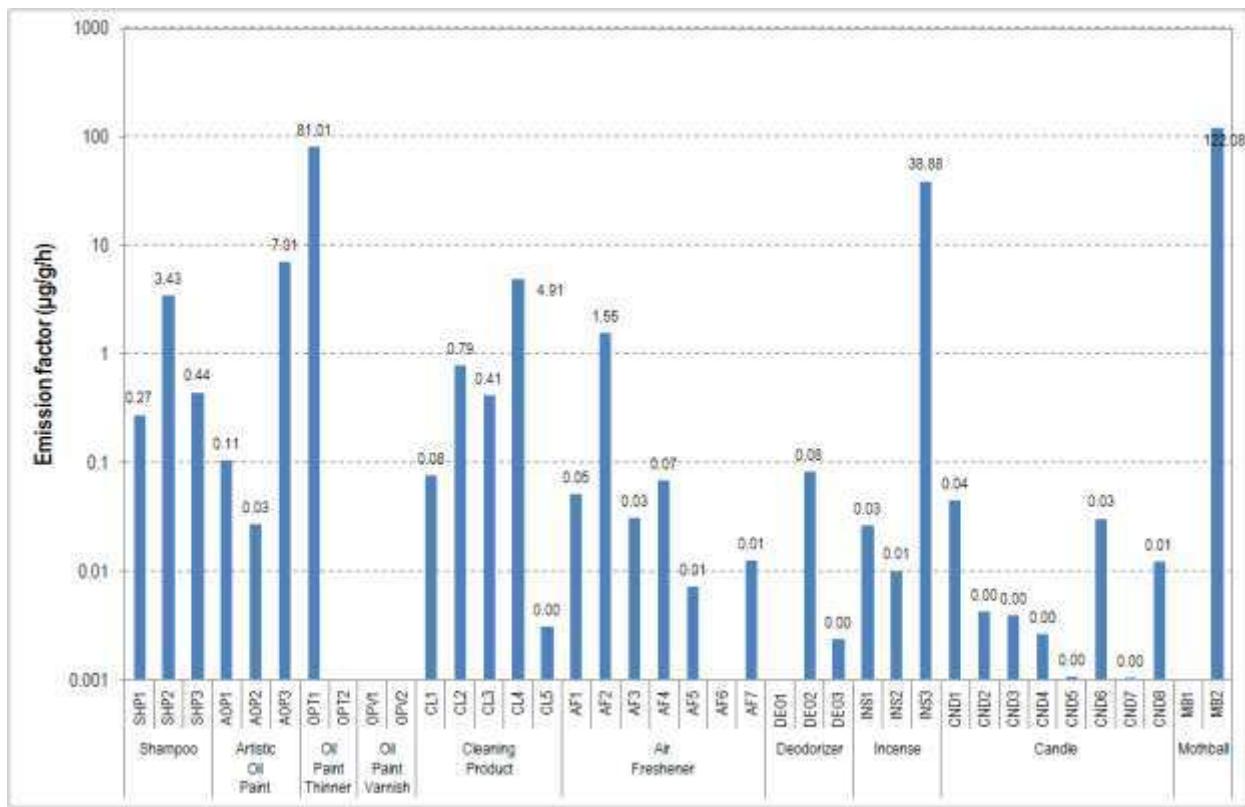


Figure A. 99: Emission factors for consumer/personal-care products (#36: 1,3(4)-dimethylbenzene)

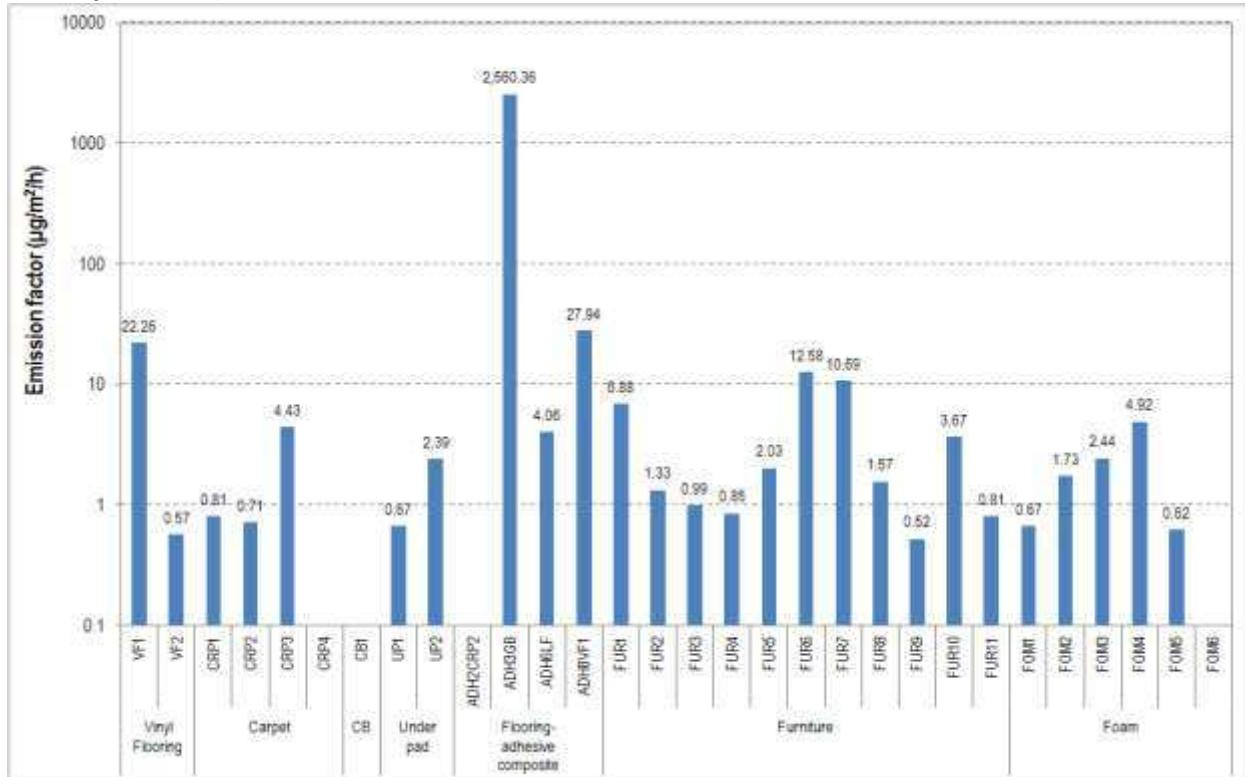


Figure A. 100: Emission factors for solid building materials and furnishings (#37: 1,3,5-trimethylbenzene)

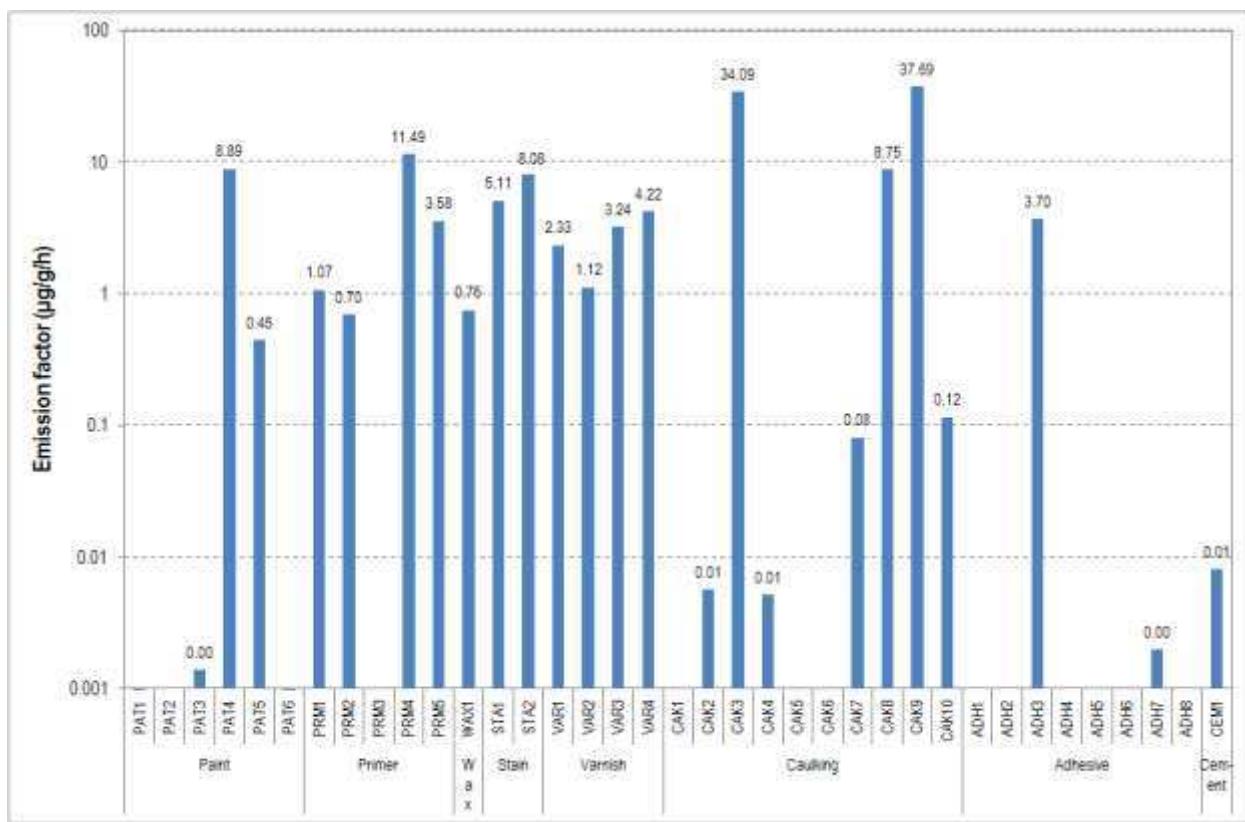


Figure A. 101: Emission factors for liquid building materials (#37: 1,3,5-trimethylbenzene)

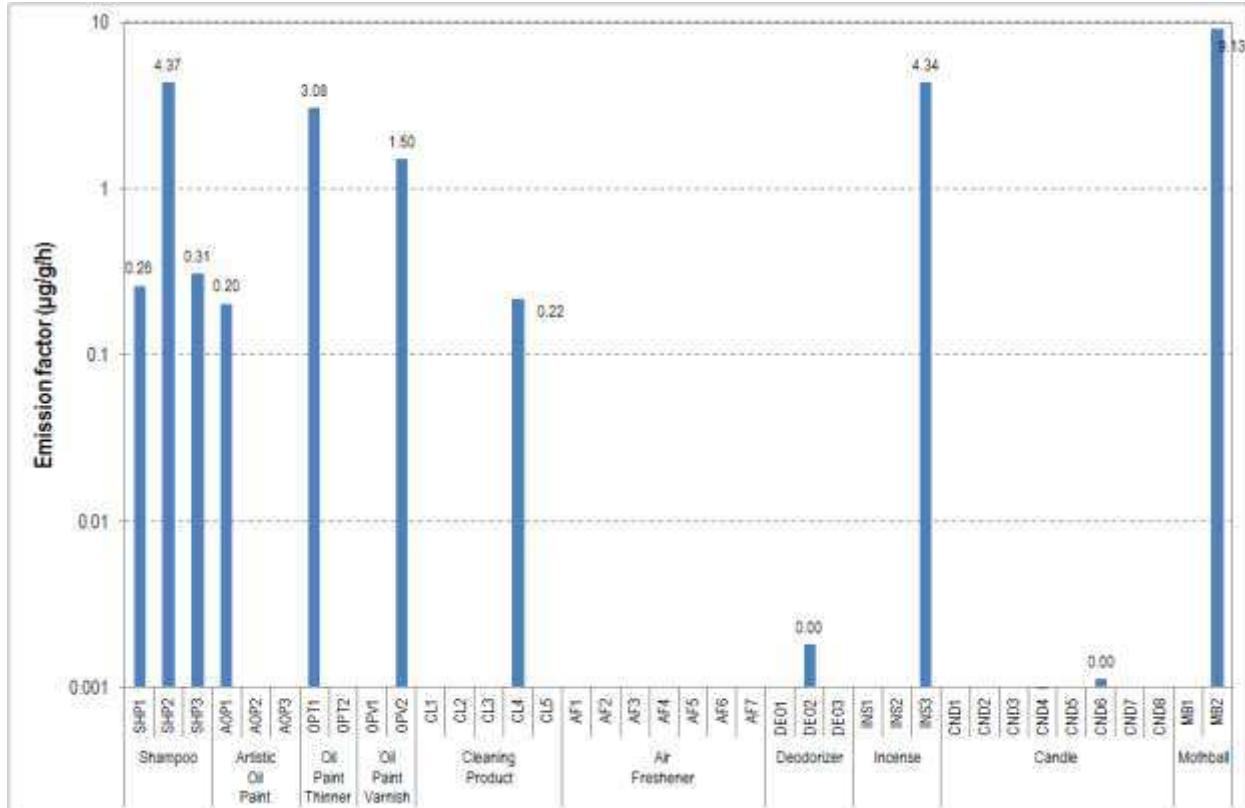


Figure A. 102: Emission factors for consumer/personal-care products (#37: 1,3,5-trimethylbenzene)

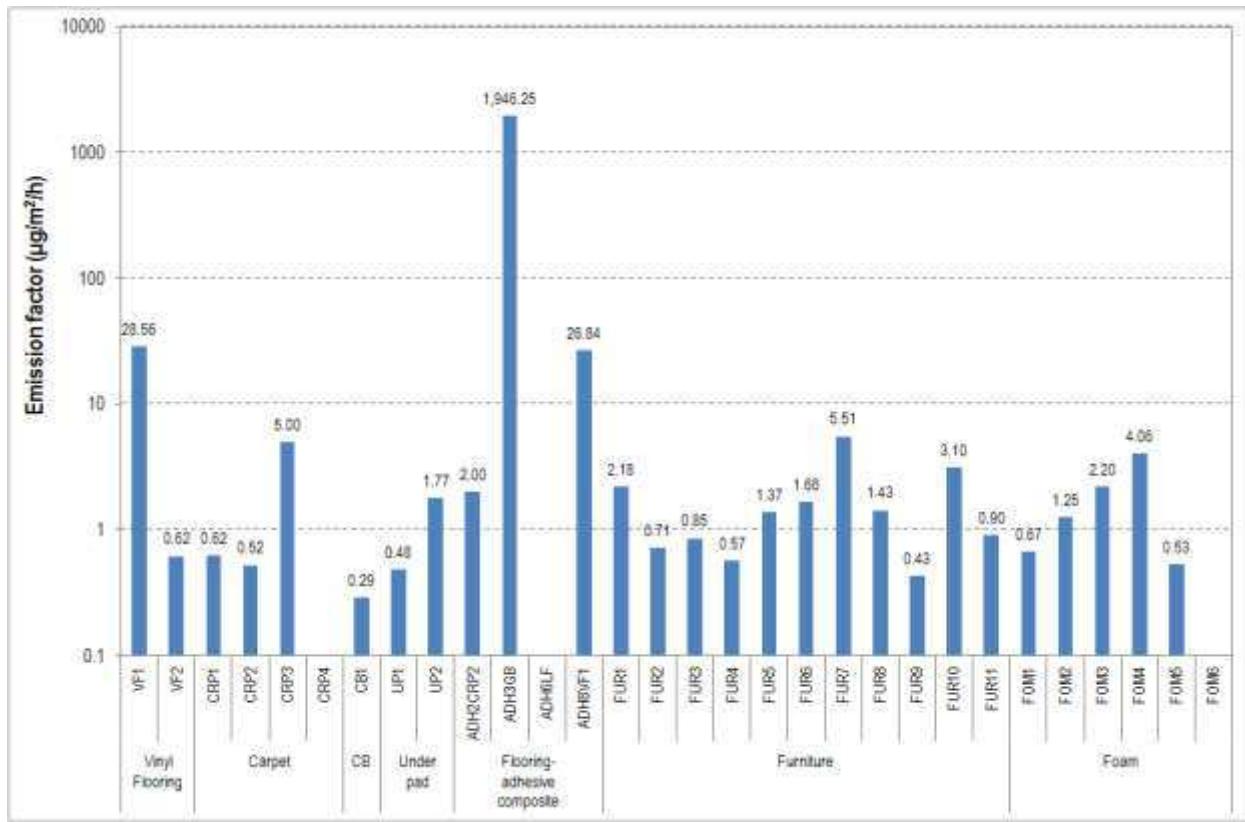


Figure A. 103: Emission factors for solid building materials and furnishings (#38: 2-ethyltoluene)

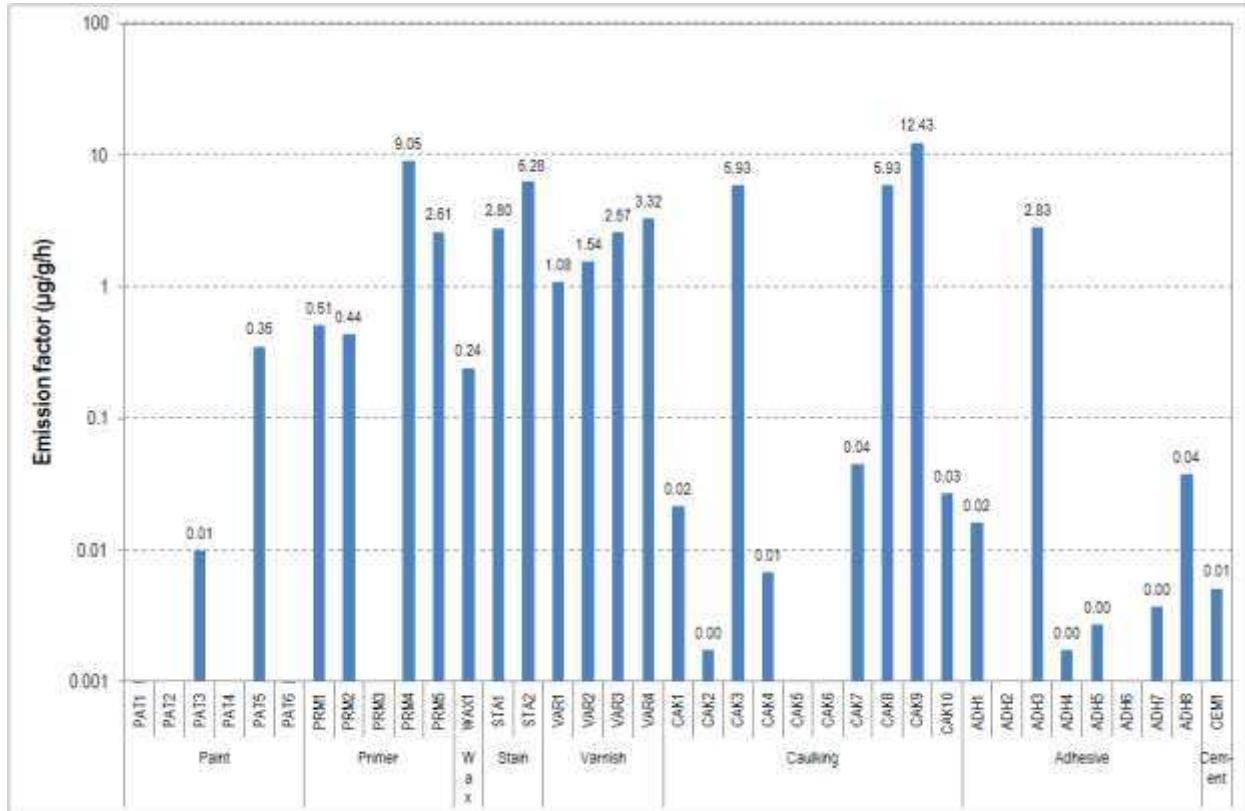


Figure A. 104: Emission factors for liquid building materials (#38: 2-ethyltoluene)

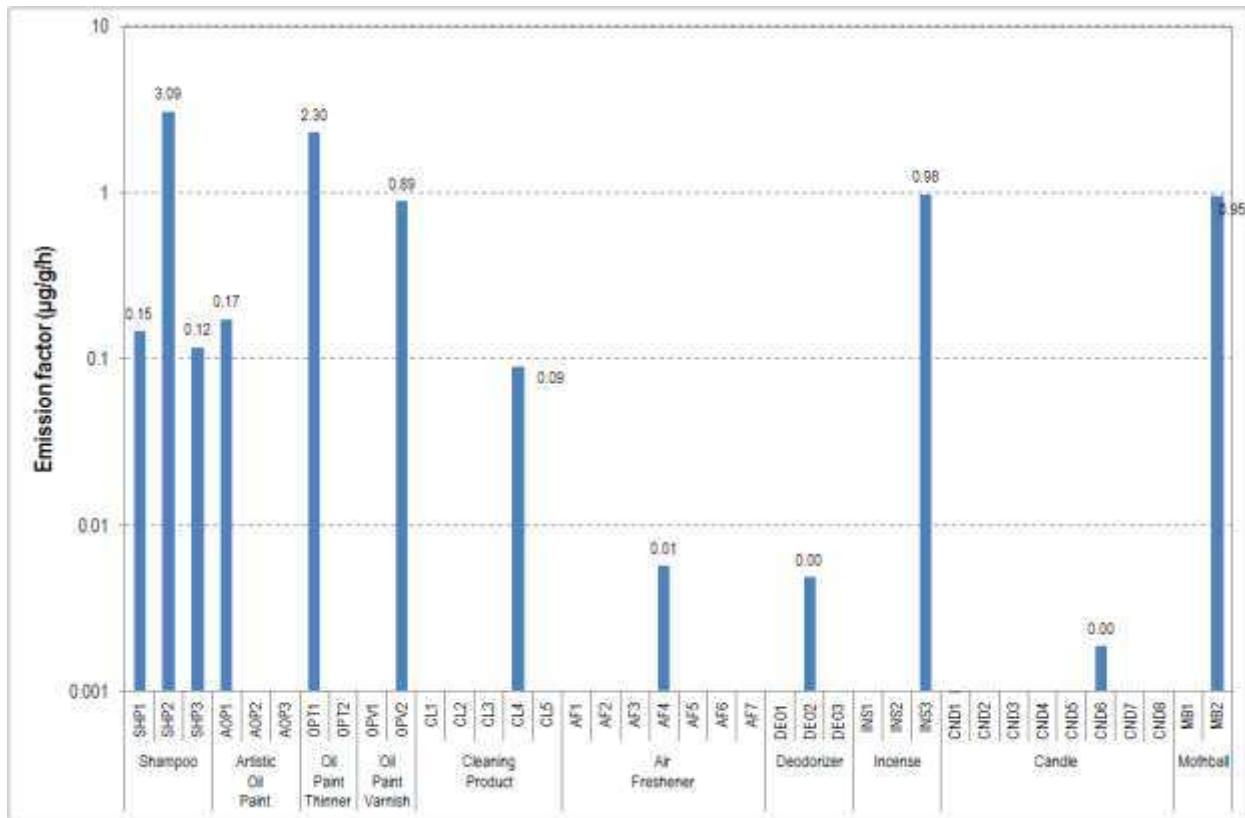


Figure A. 105: Emission factors for consumer/personal-care products (#38: 2-ethyltoluene)

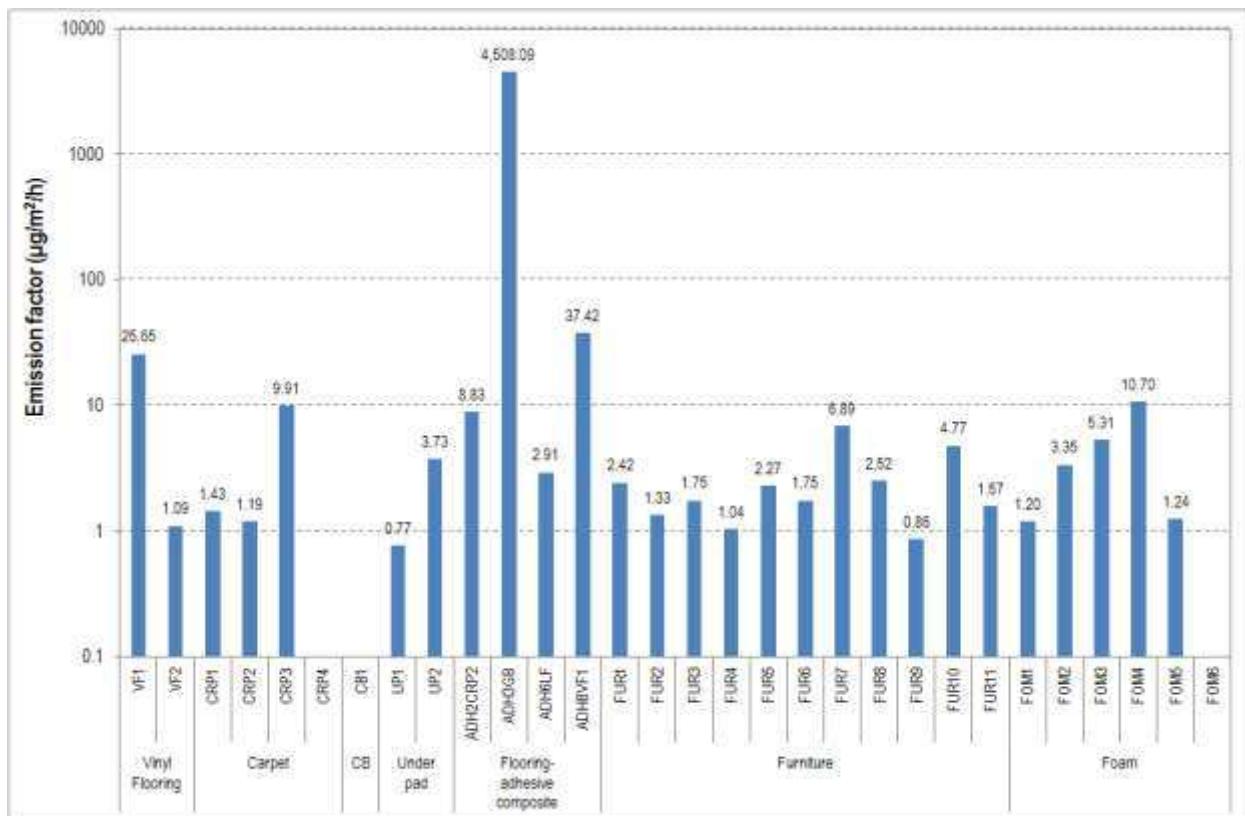


Figure A. 106: Emission factors for solid building materials and furnishings (#39: 3-ethyltoluene)

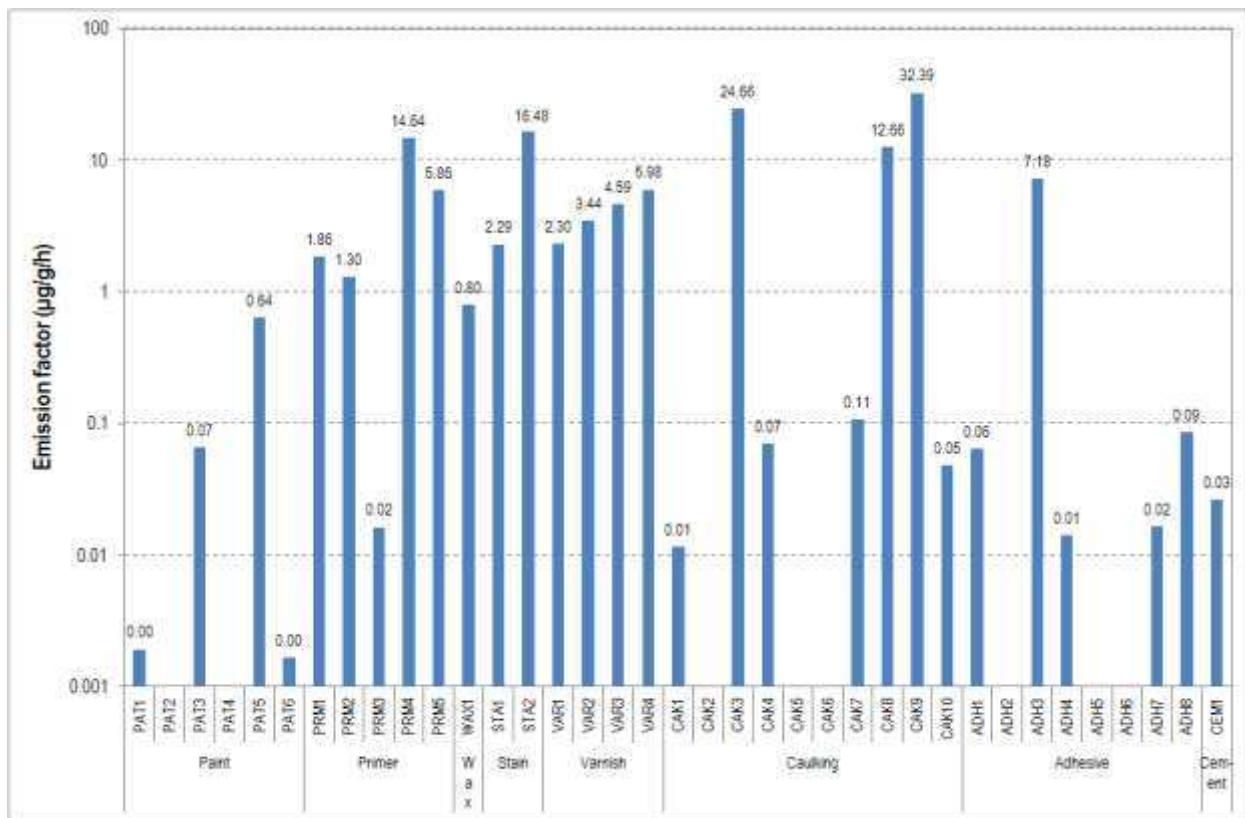


Figure A. 107: Emission factors for liquid building materials (#39: 3-ethyltoluene)

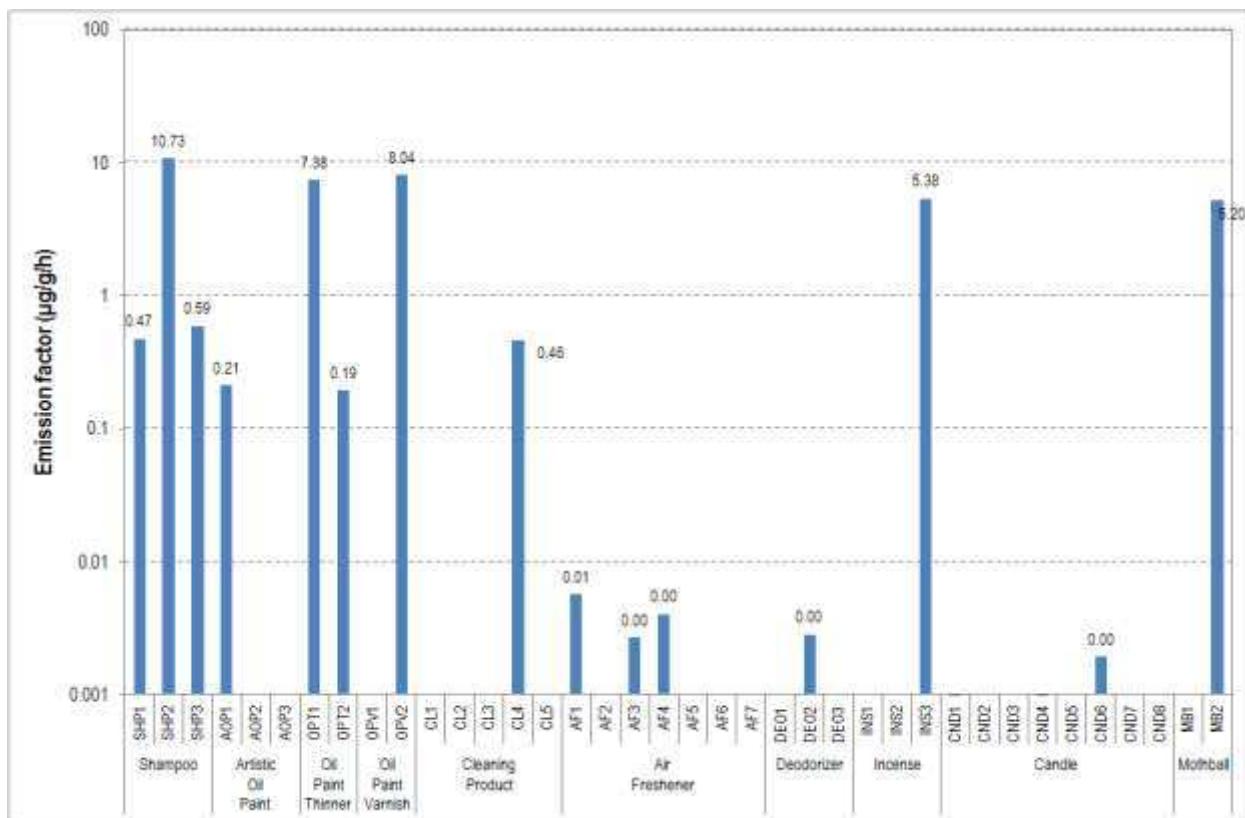


Figure A. 108: Emission factors for consumer/personal-care products (#39: 3-ethyltoluene)

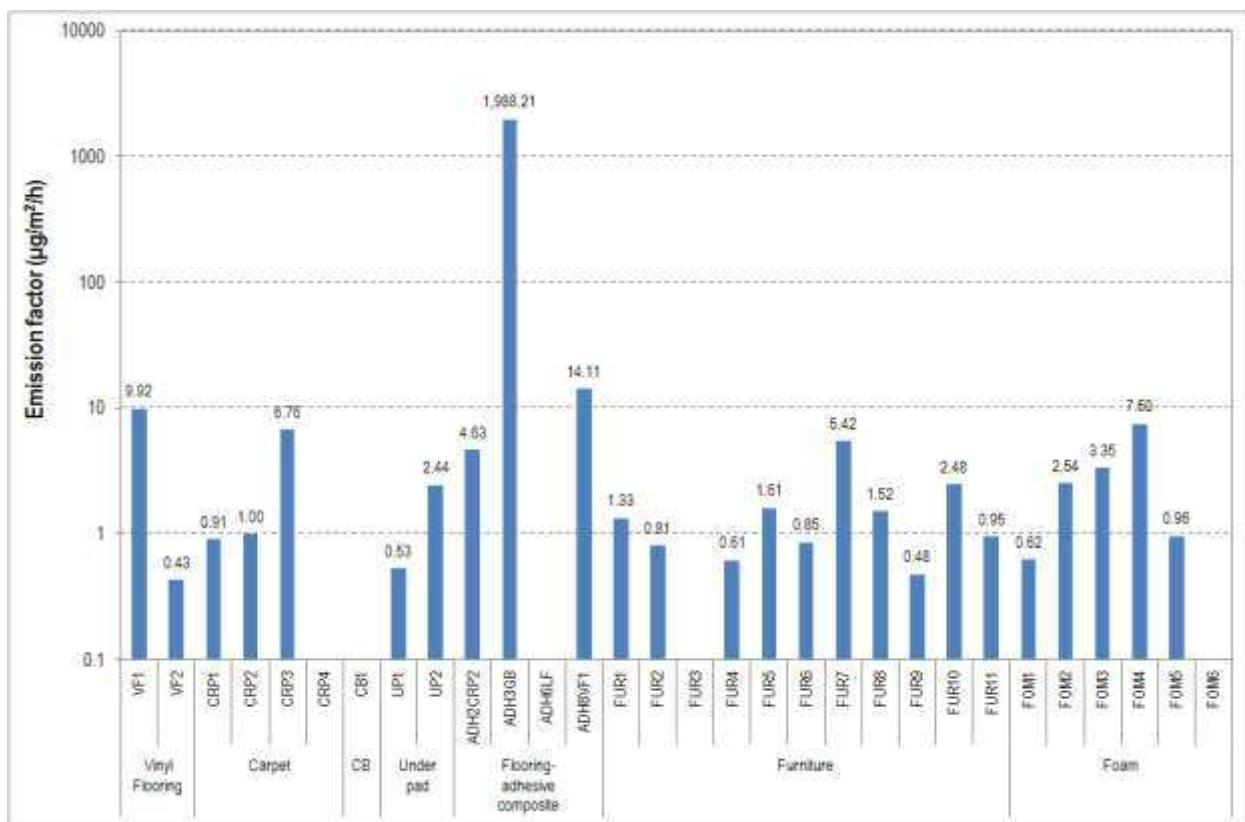


Figure A. 109: Emission factors for solid building materials and furnishings (#40: 4-ethyltoluene)

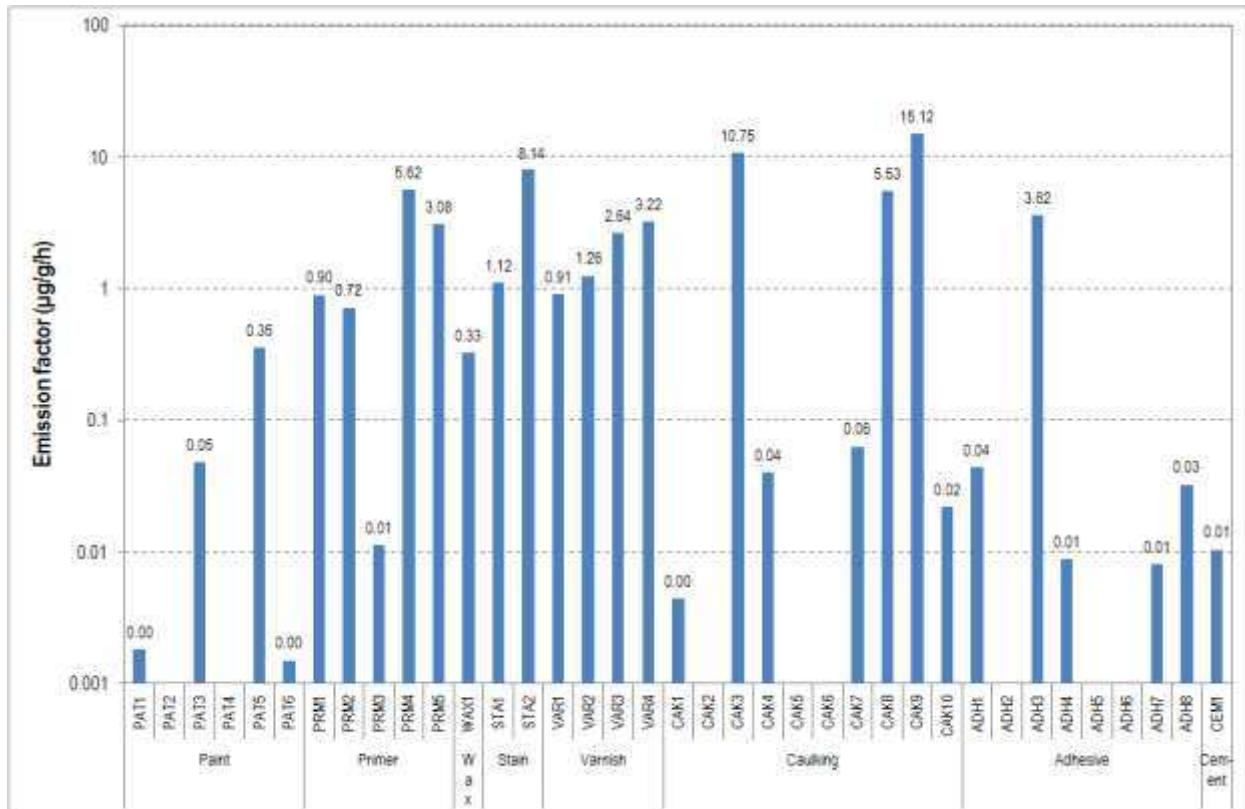


Figure A. 110: Emission factors for liquid building materials (#40: 4-ethyltoluene)

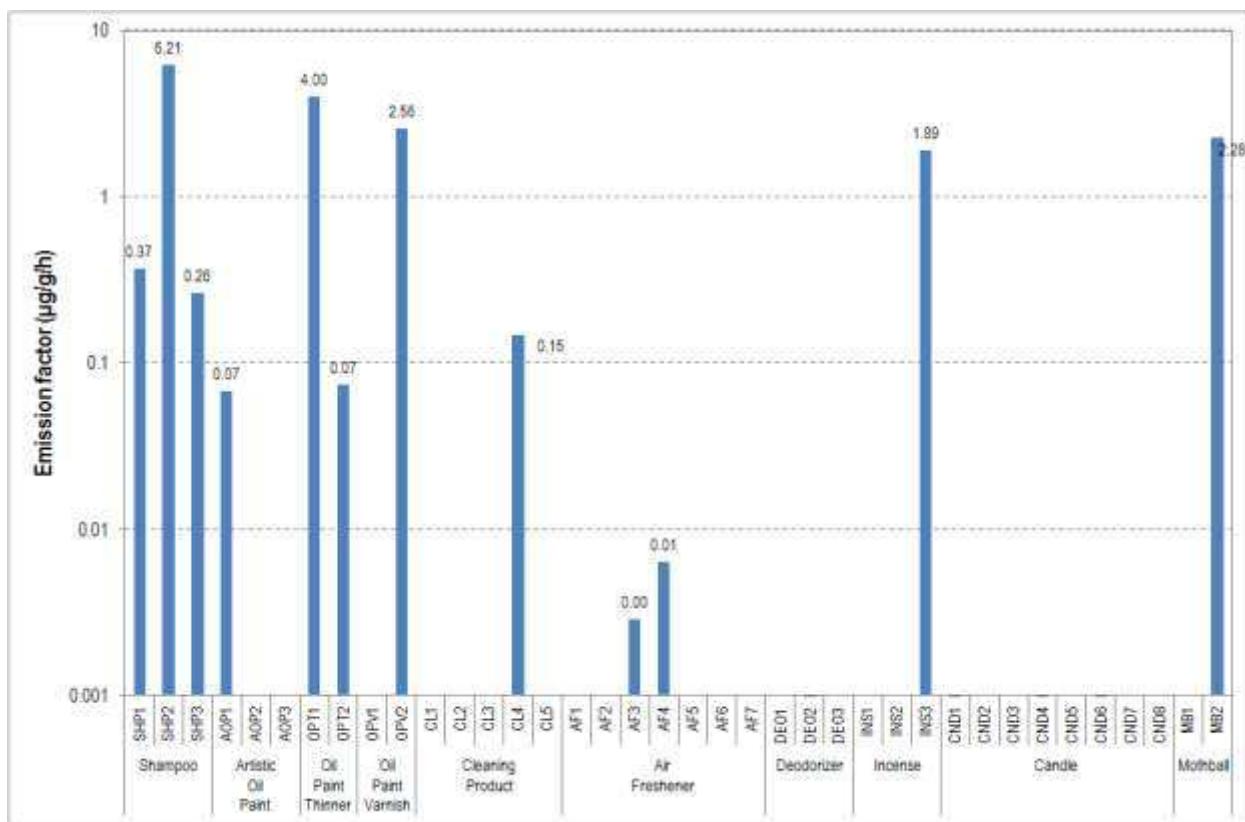


Figure A. 111: Emission factors for consumer/personal-care products (#40: 4-ethyltoluene)

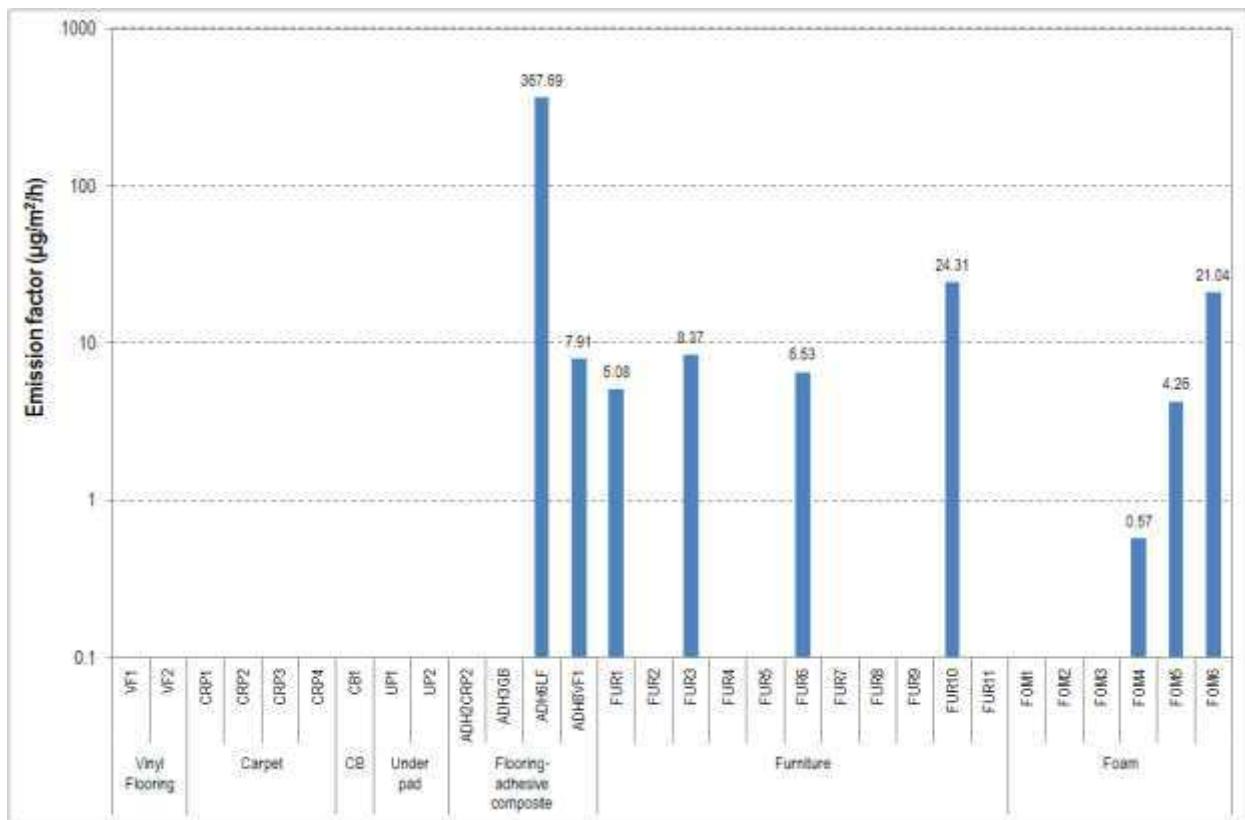


Figure A. 112: Emission factors for solid building materials and furnishings (#41: benzene)

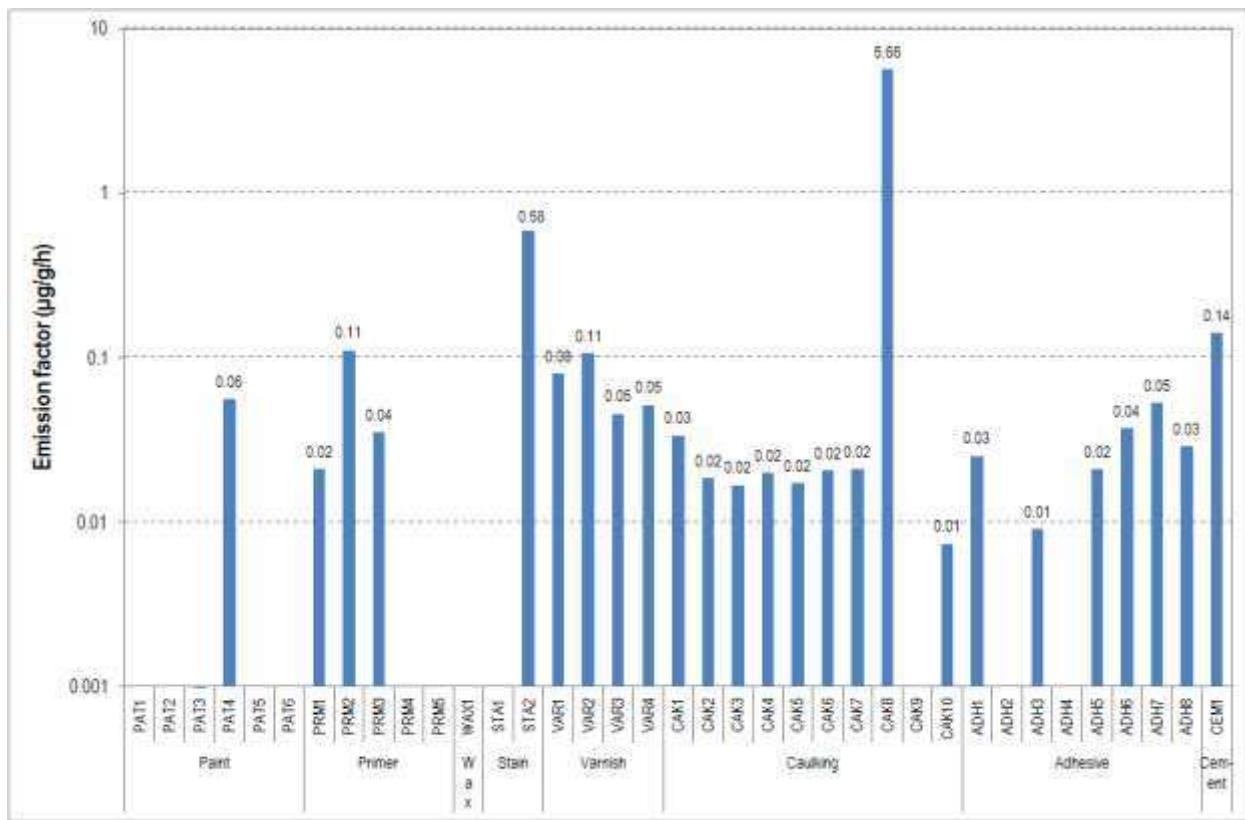


Figure A. 113: Emission factors for liquid building materials (#41: benzene)

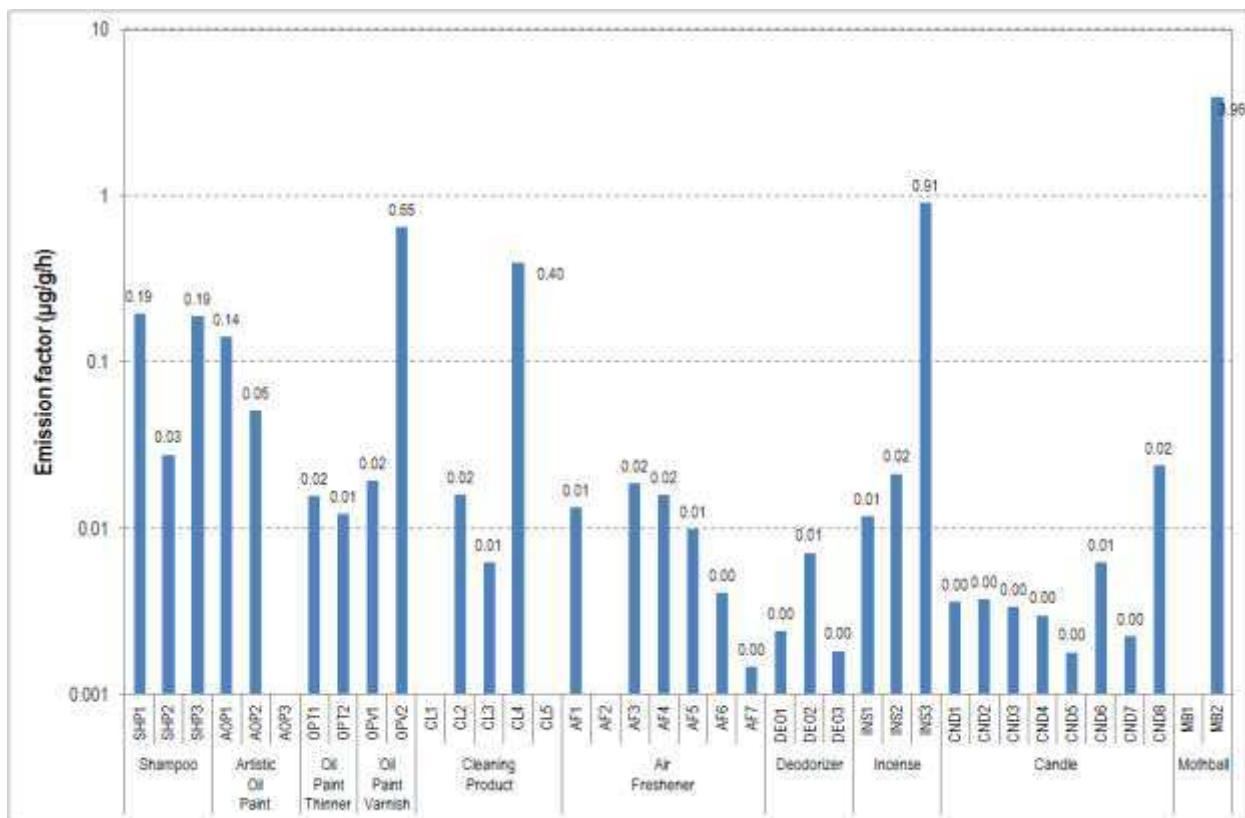


Figure A. 114: Emission factors for consumer/personal-care products (#41: benzene)

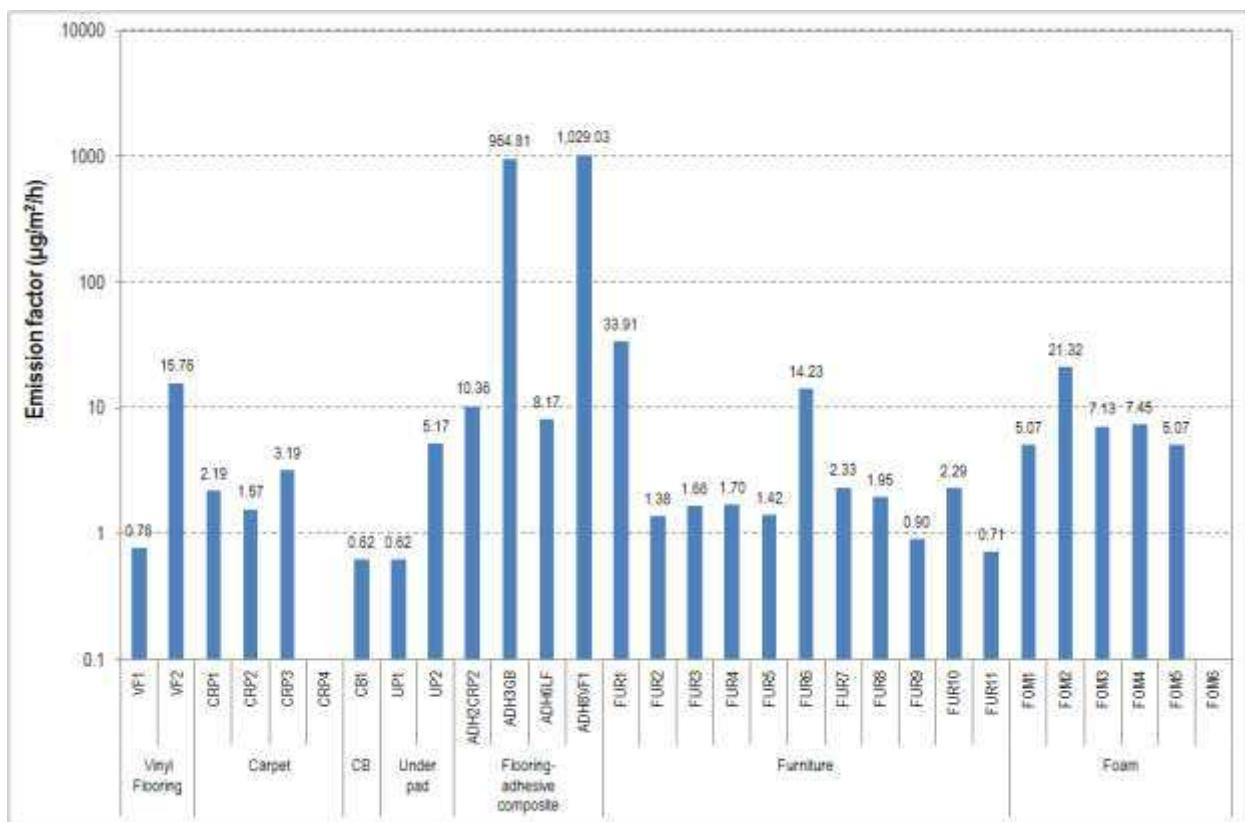


Figure A. 115: Emission factors for solid building materials and furnishings (#42: ethylbenzene)

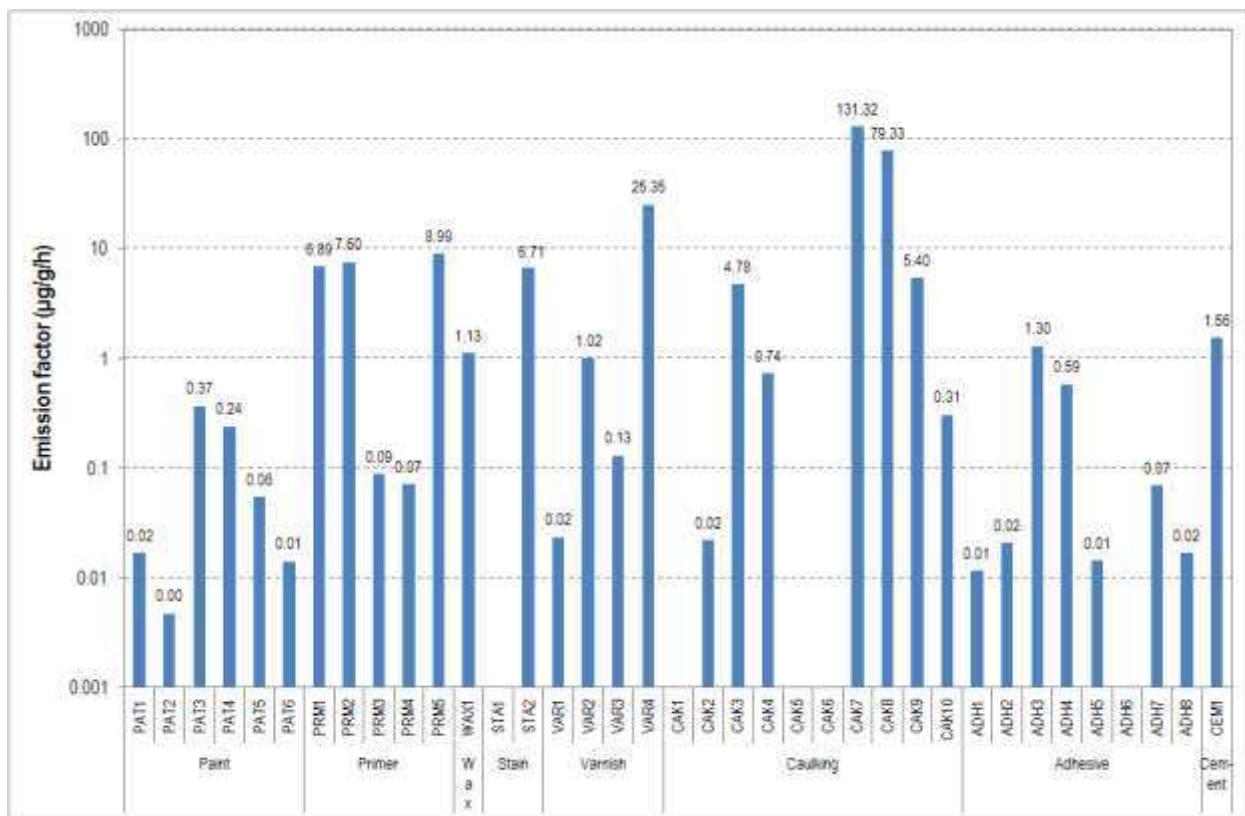


Figure A. 116: Emission factors for liquid building materials (#42: ethylbenzene)

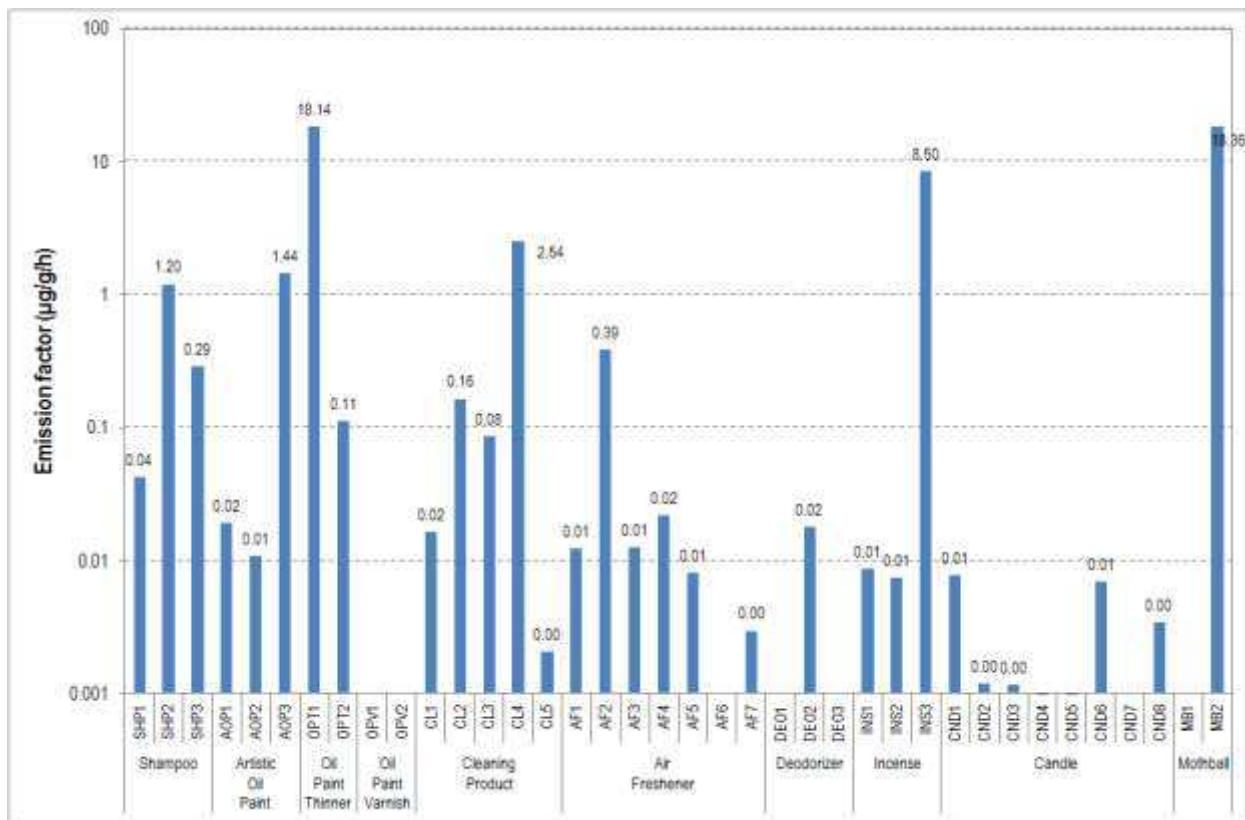


Figure A. 117: Emission factors for consumer/personal-care products (#42: ethylbezene)

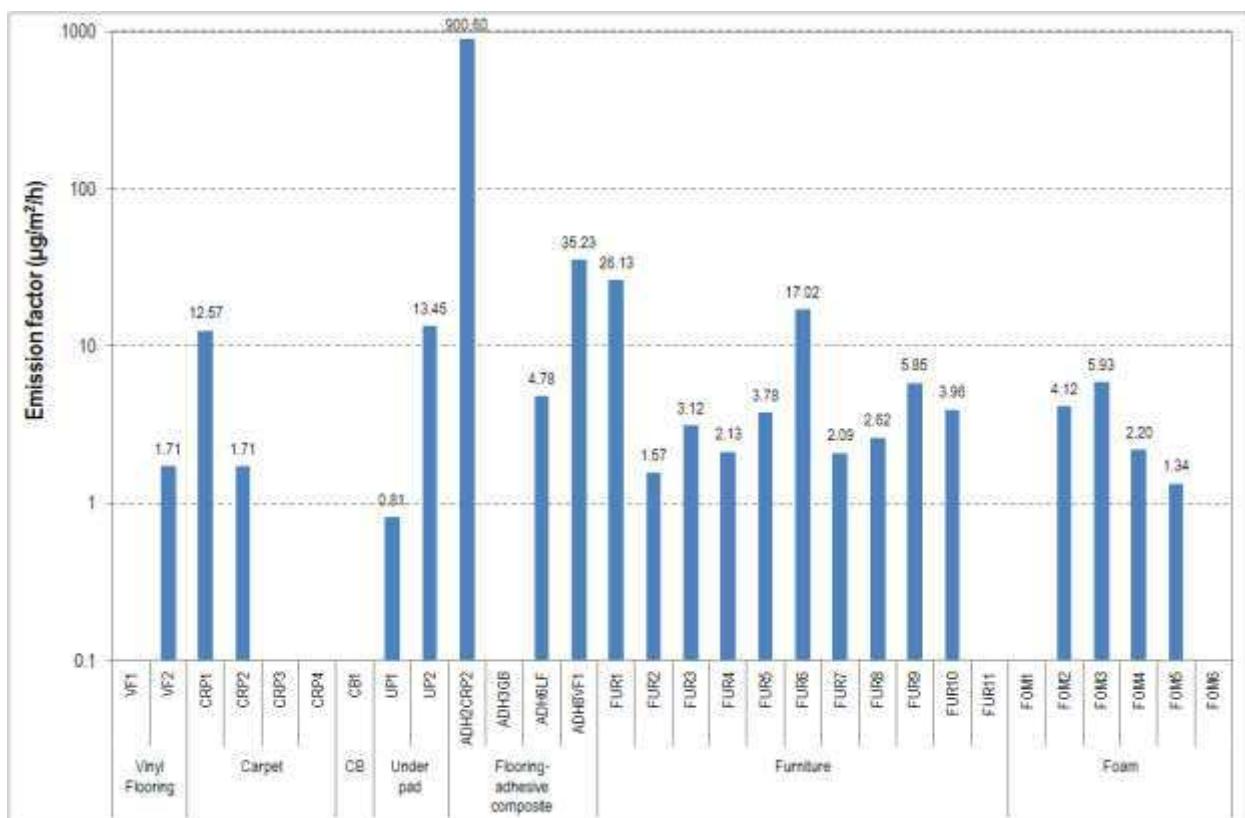


Figure A. 118: Emission factors for solid building materials and furnishings (#43 styrene)

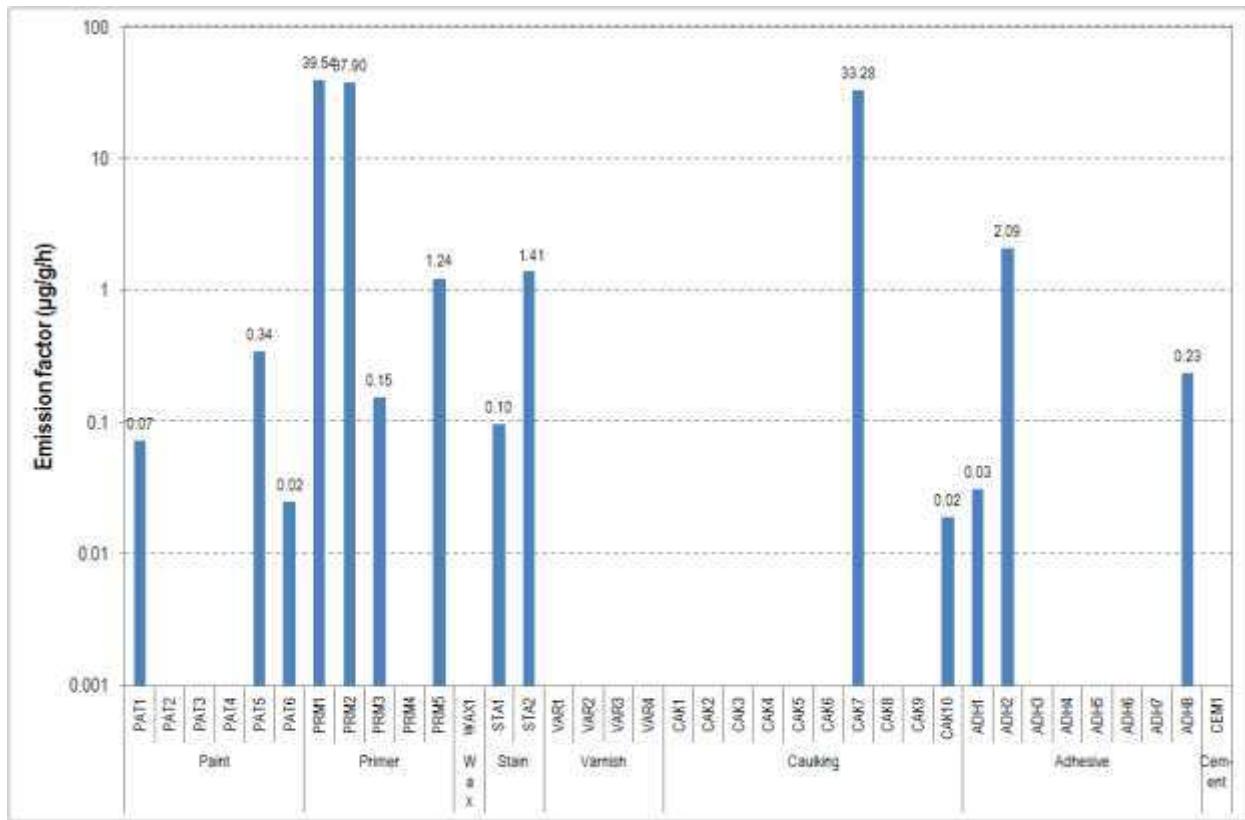


Figure A. 119: Emission factors for liquid building materials (#43: styrene)

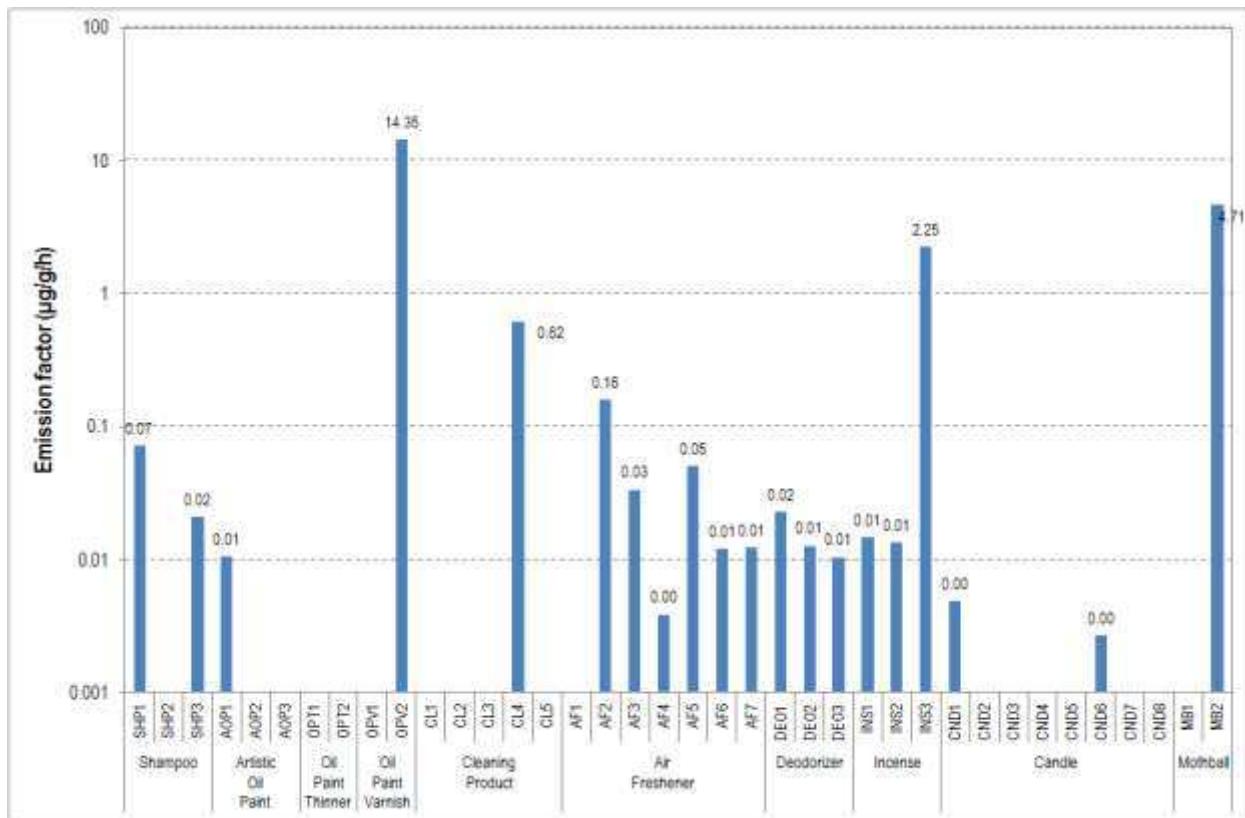


Figure A. 120: Emission factors for consumer/personal-care products (#43: styrene)

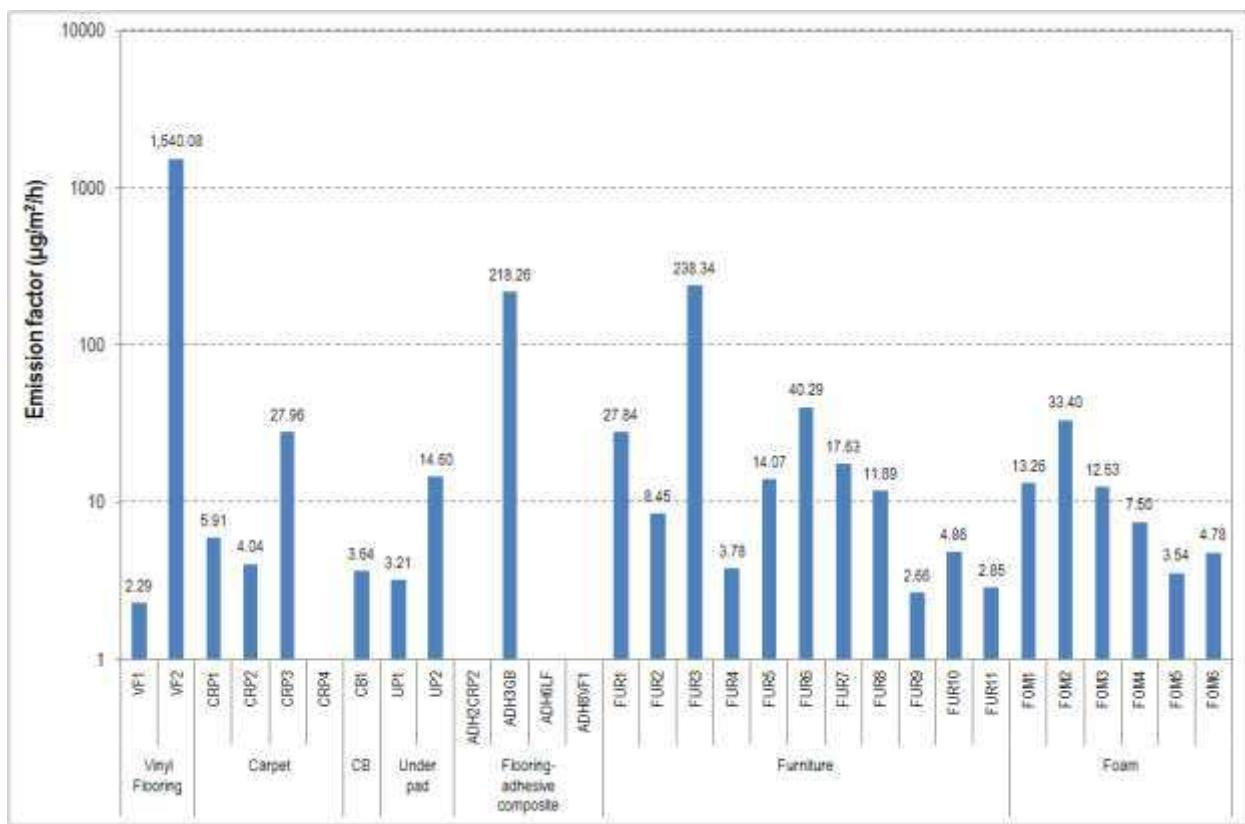


Figure A. 121: Emission factors for solid building materials and furnishings (#44: toluene)

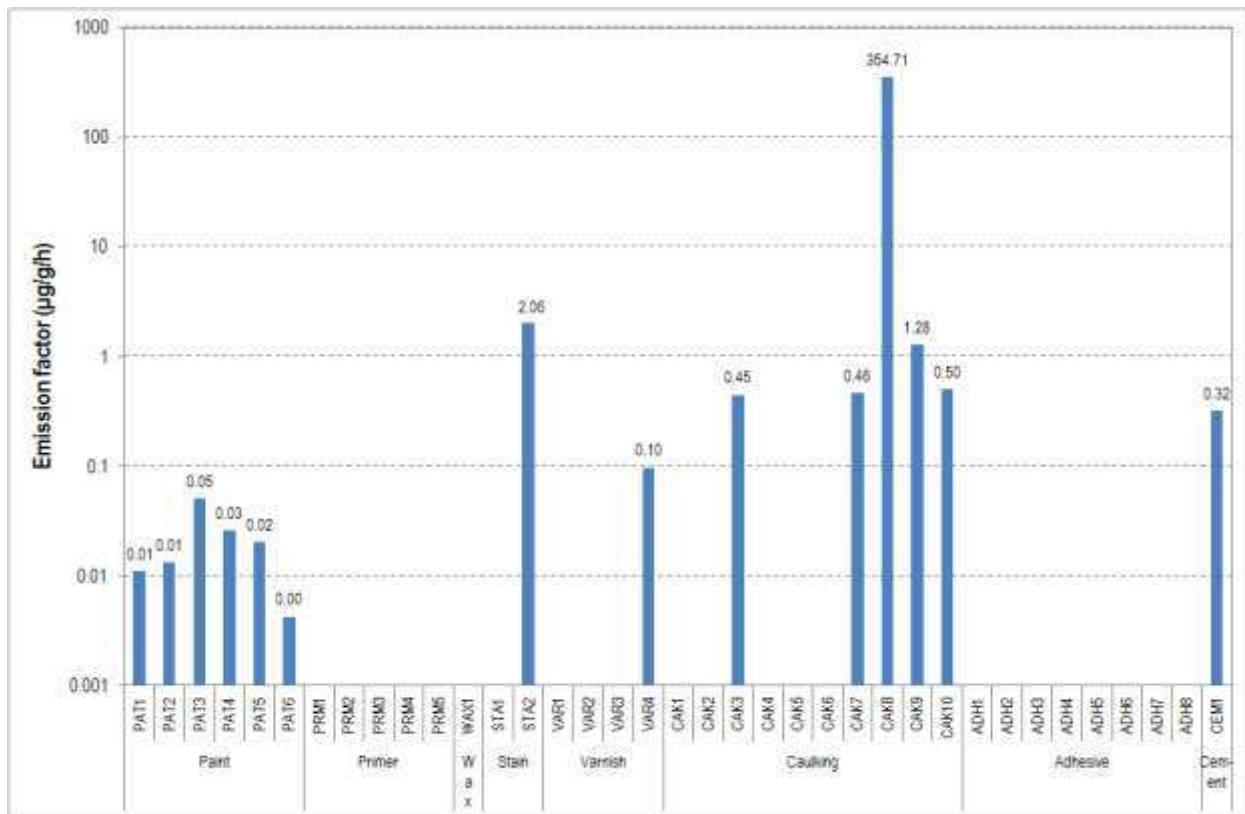


Figure A. 122: Emission factors for liquid building materials (#44: toluene)

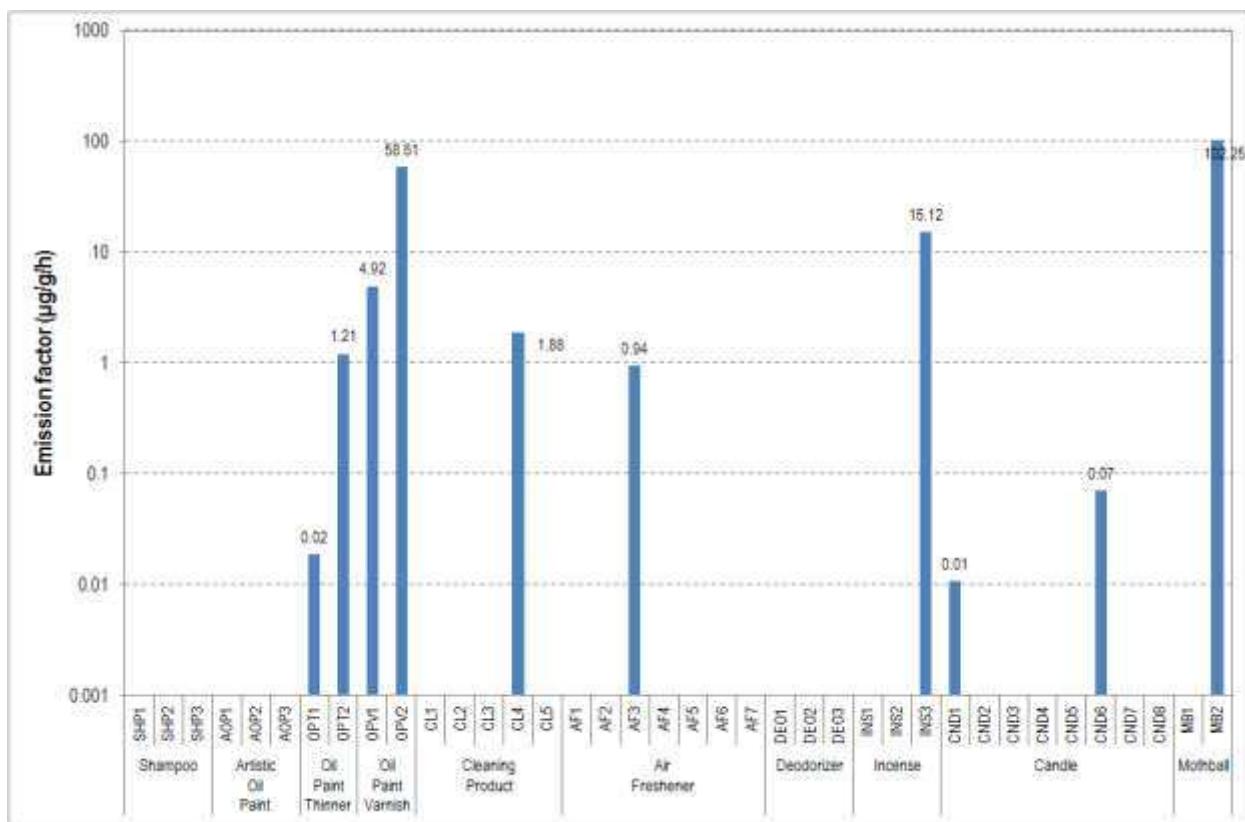


Figure A. 123: Emission factors for consumer/personal-care products (#44: toluene)

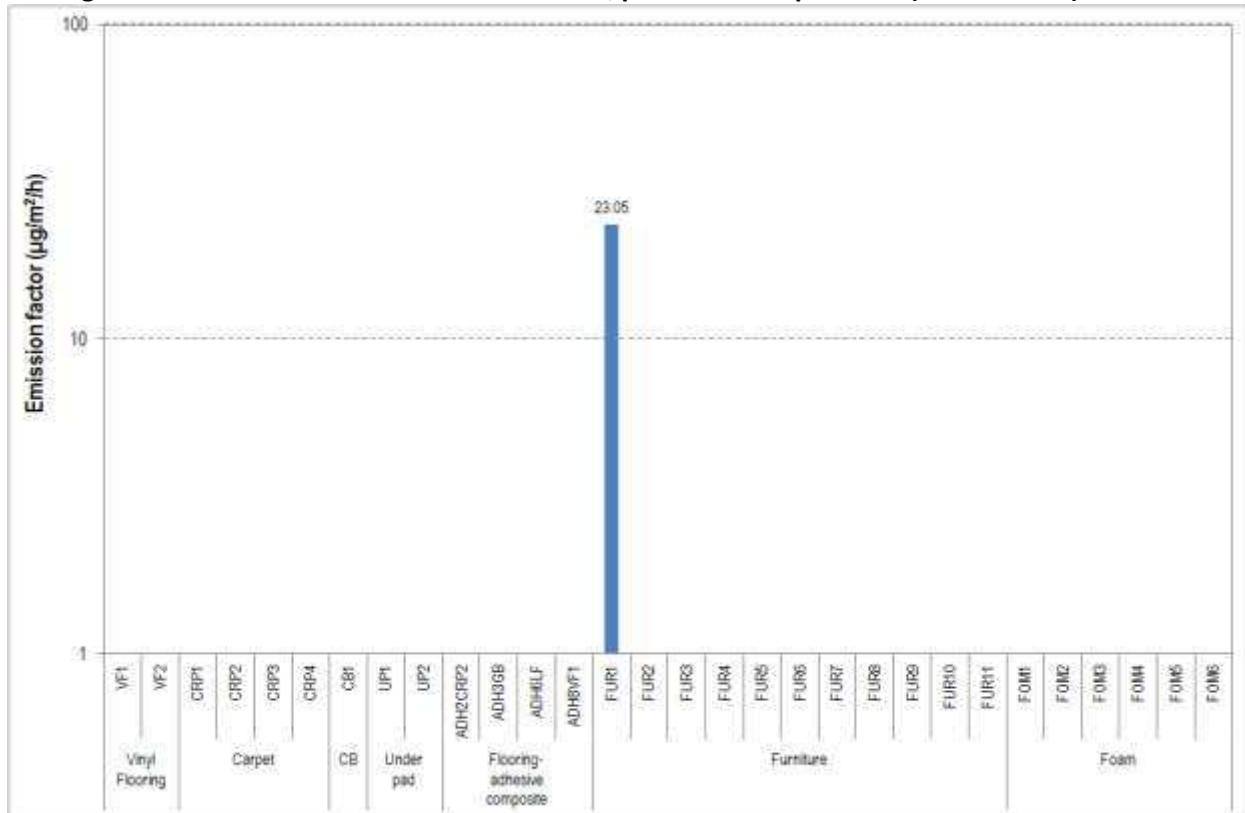


Figure A. 124: Emission factors for solid building materials and furnishings (#45: 2-ethoxyethyl acetate)

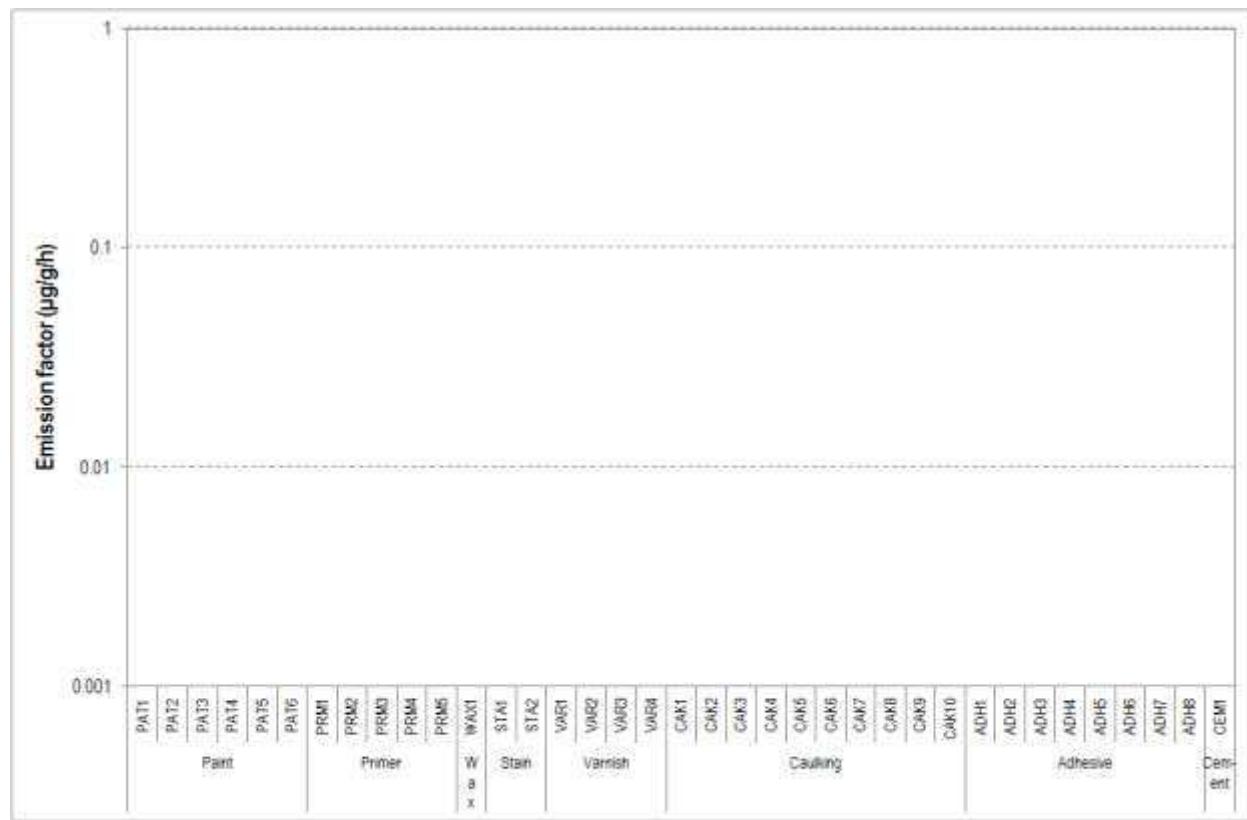


Figure A. 125: Emission factors for liquid building materials (#45: 2-ethoxyethyl acetate)

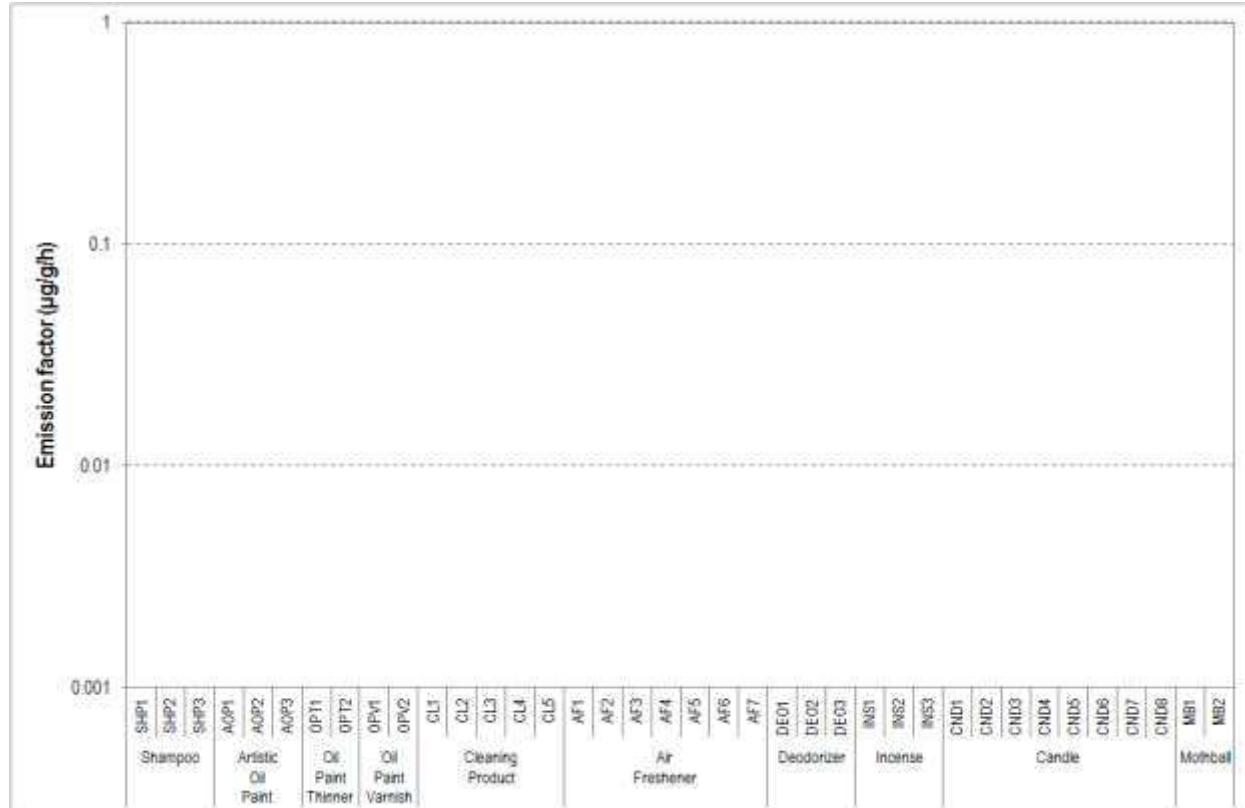


Figure A. 126: Emission factors for consumer/personal-care products (#45: 2-ethoxyethyl acetate)

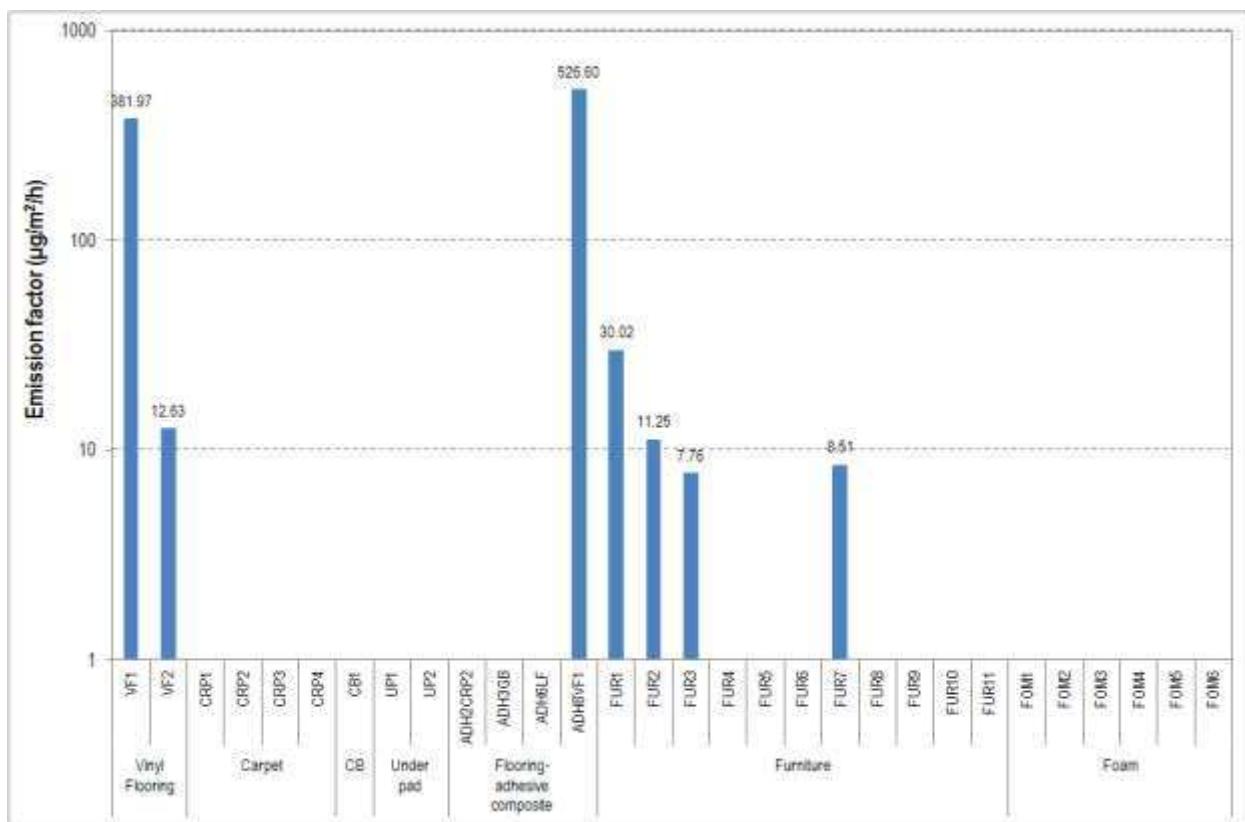


Figure A. 127: Emission factors for solid building materials and furnishings (#46: butyl acetate)

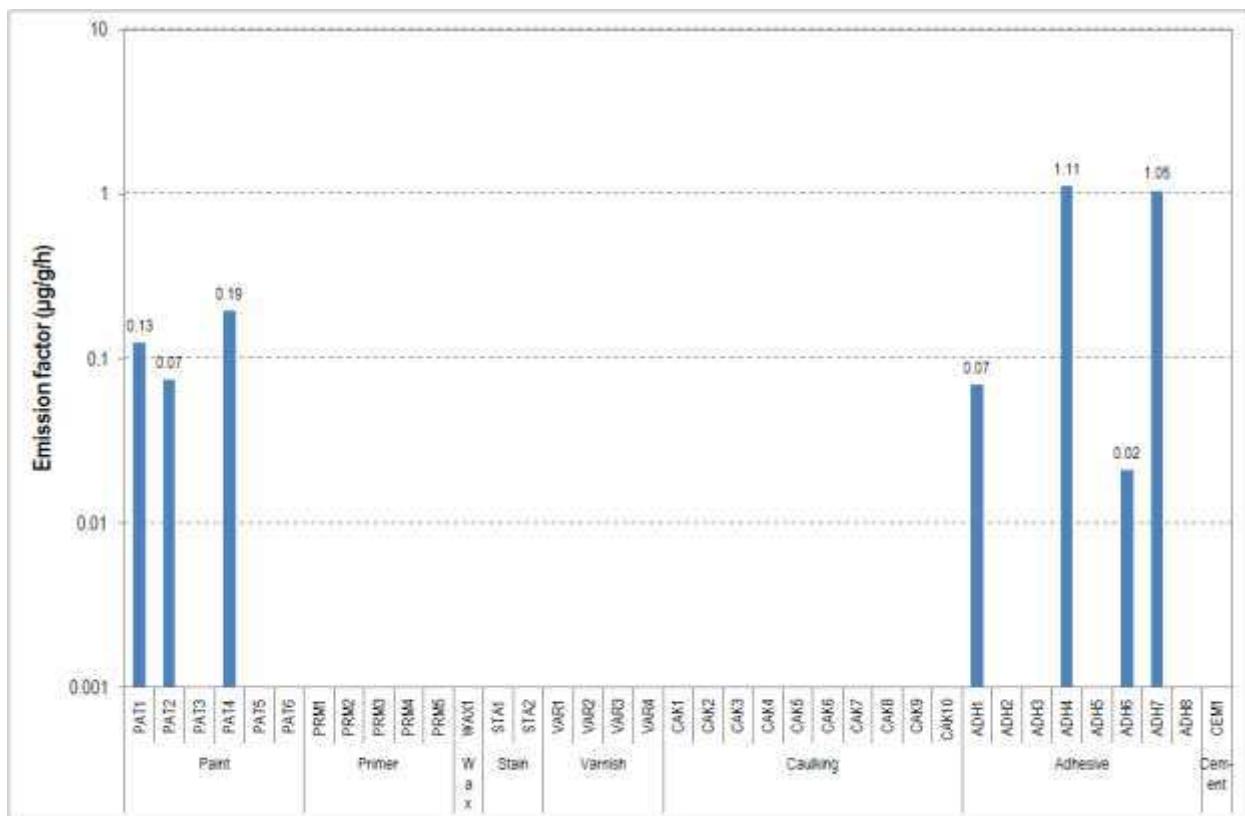


Figure A. 128: Emission factors for liquid building materials (#46: butyl acetate)

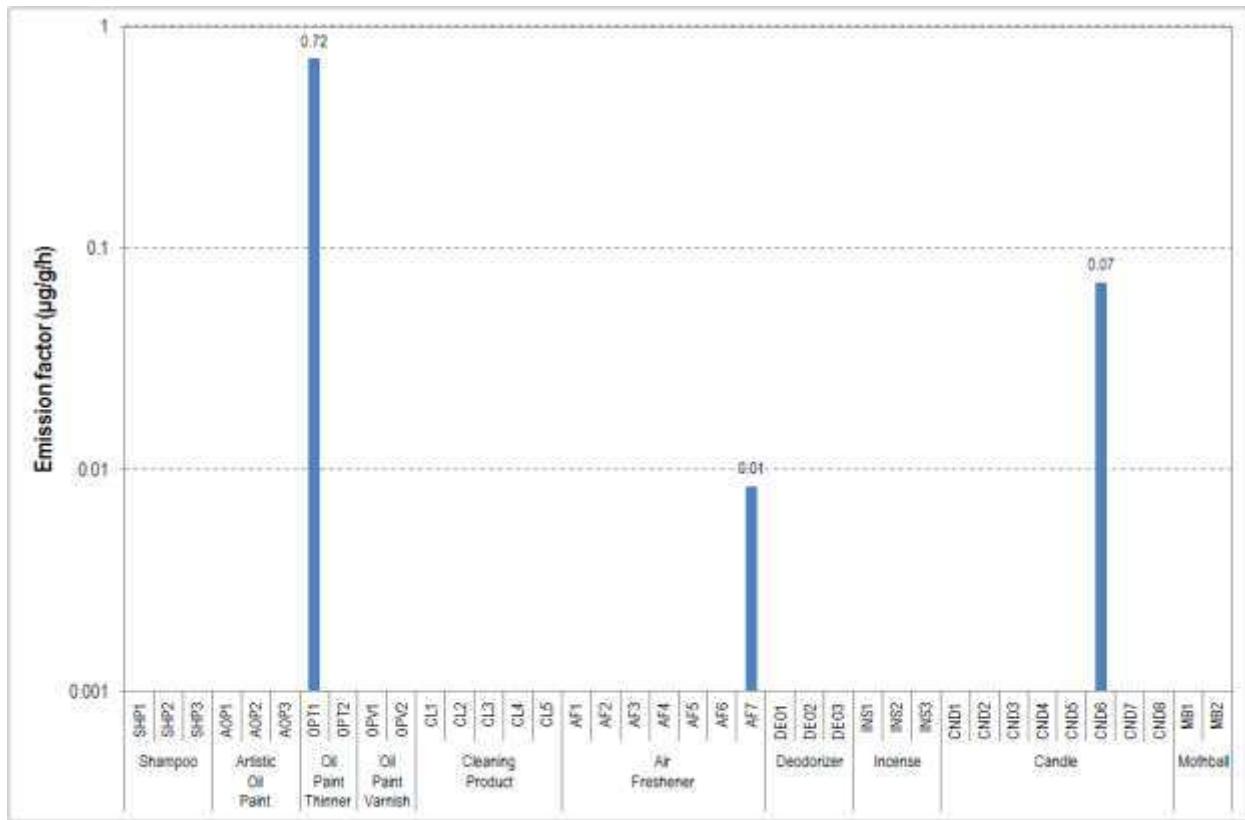


Figure A. 129: Emission factors for consumer/personal-care products (#46: butyl acetate)

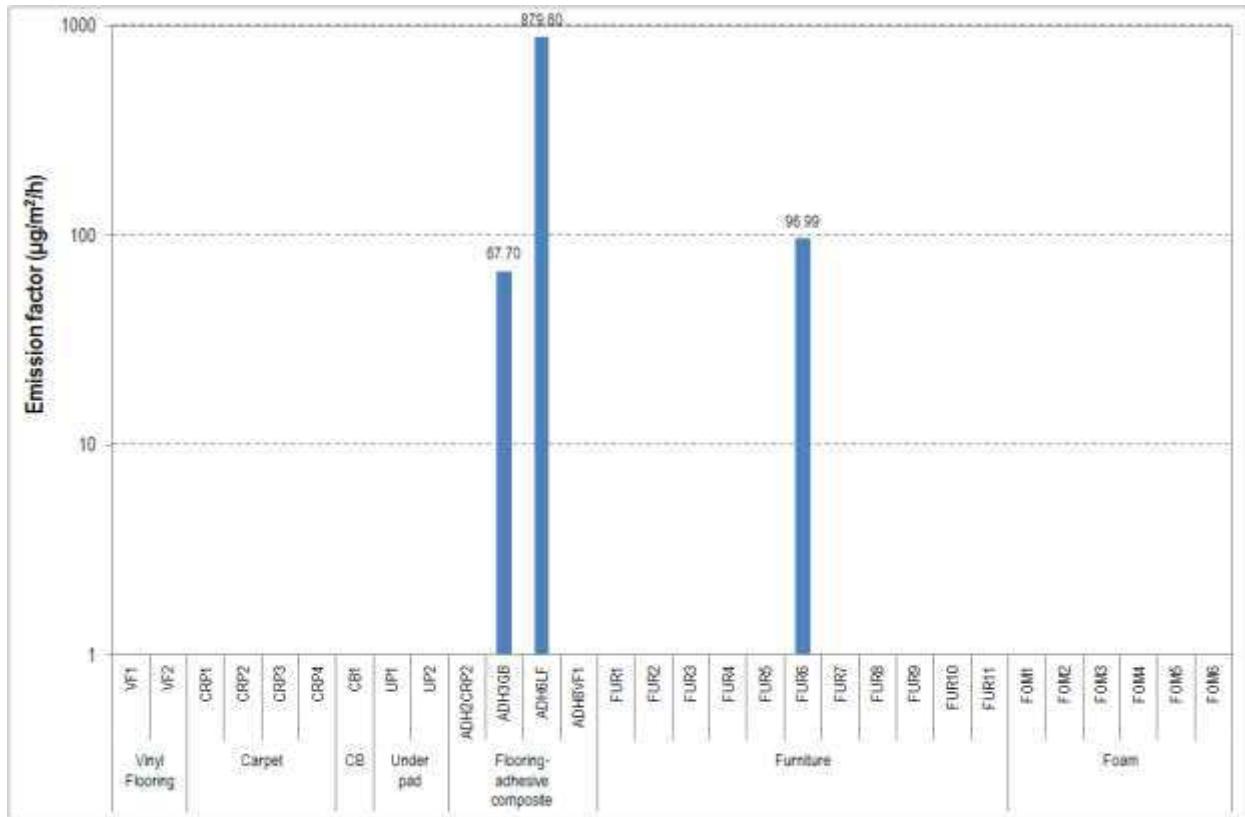


Figure A. 130: Emission factors for solid building materials and furnishings (#47: ethyl acetate)

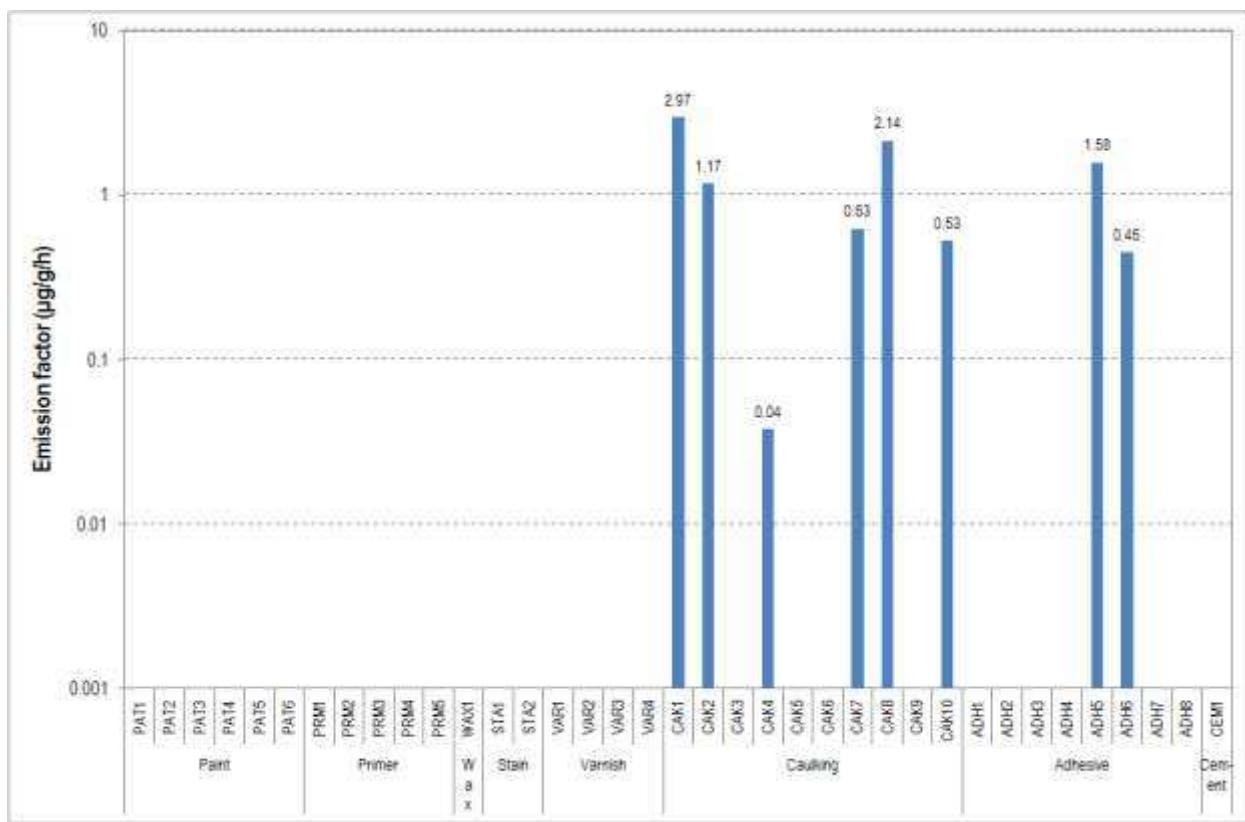


Figure A. 131: Emission factors for liquid building materials (#47: ethyl acetate)

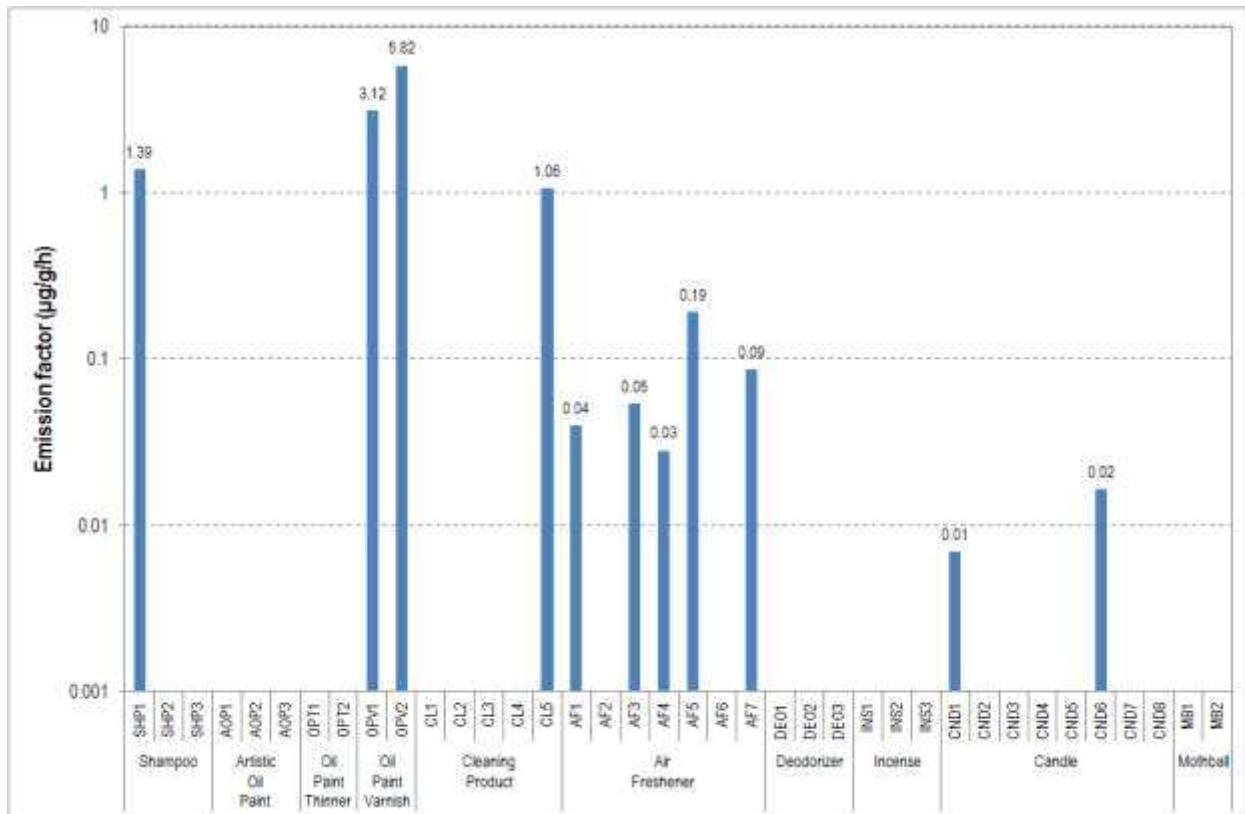


Figure A. 132: Emission factors for consumer/personal-care products (#47: ethyl acetate)

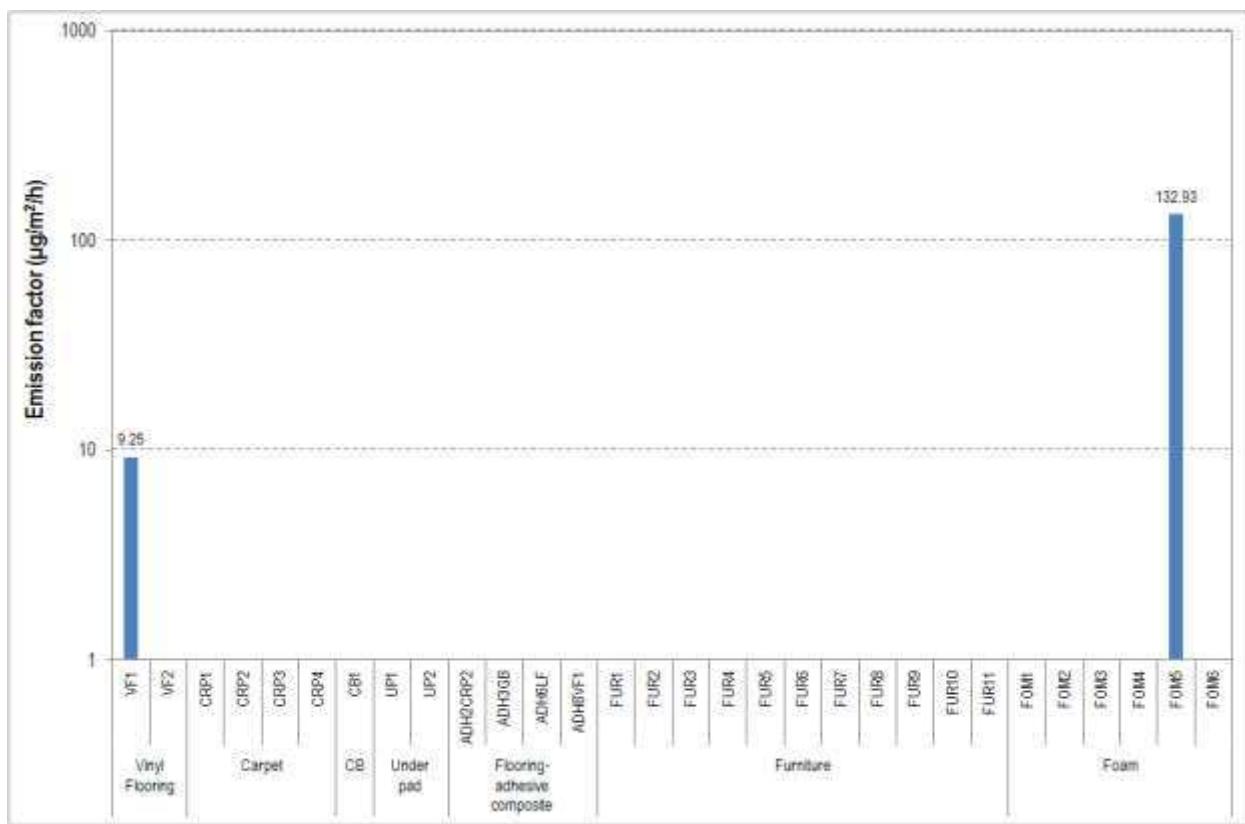


Figure A. 133: Emission factors for solid building materials and furnishings (#48: texanol)

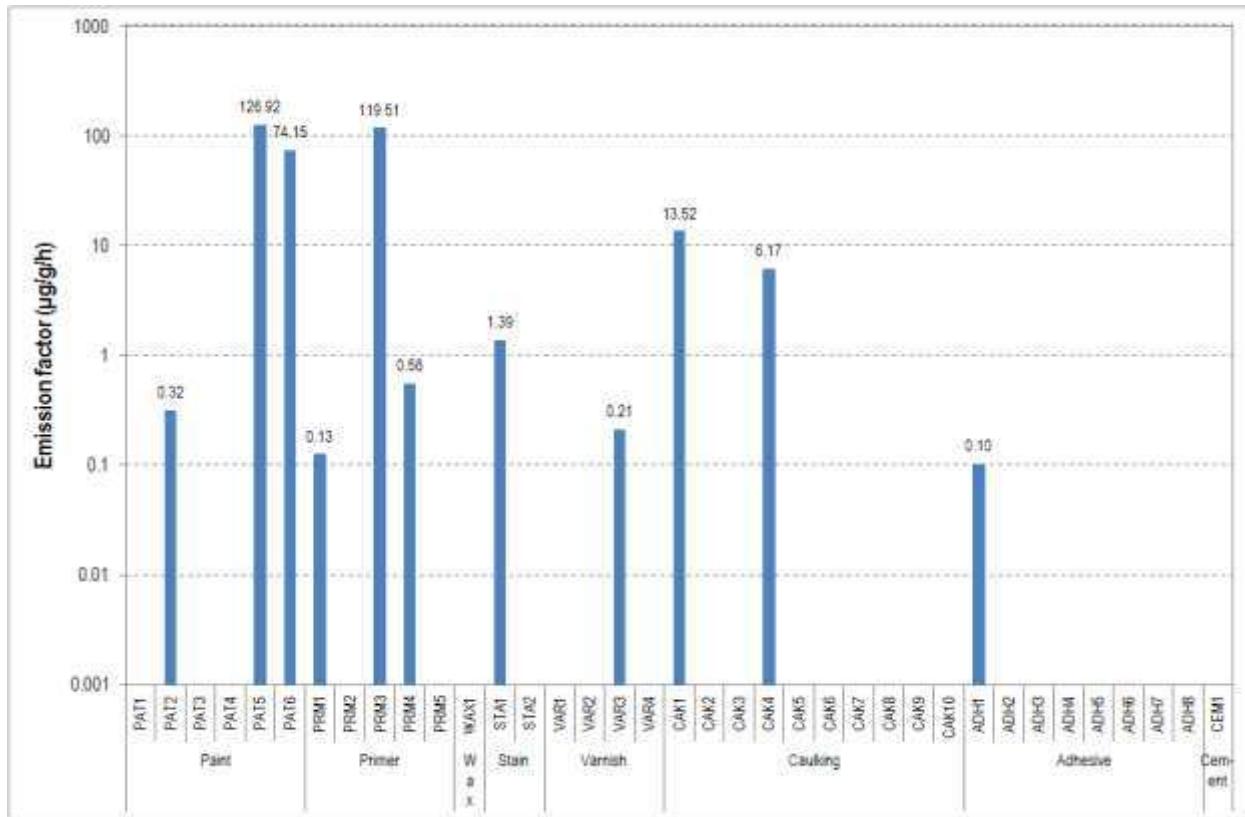


Figure A. 134: Emission factors for liquid building materials (#48: texanol)

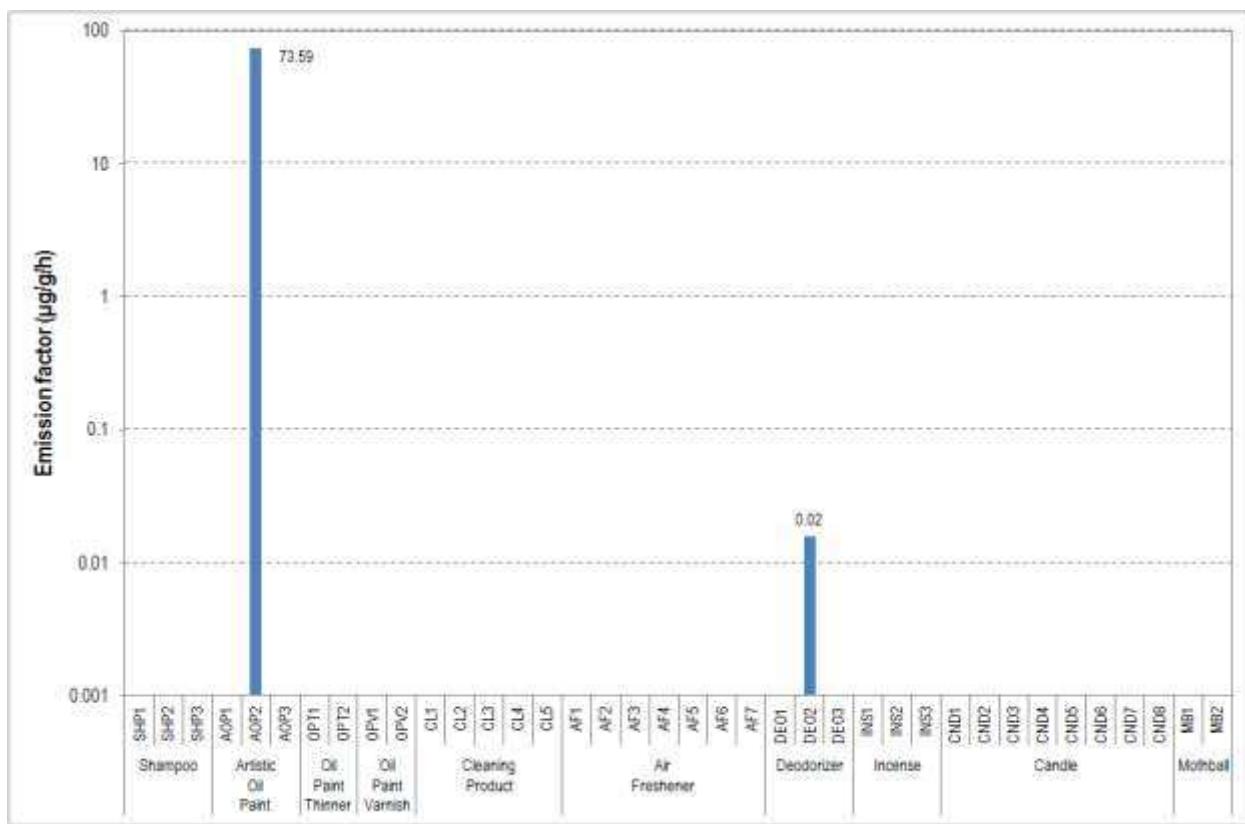


Figure A. 135: Emission factors for consumer/personal-care products (#48: texanol)

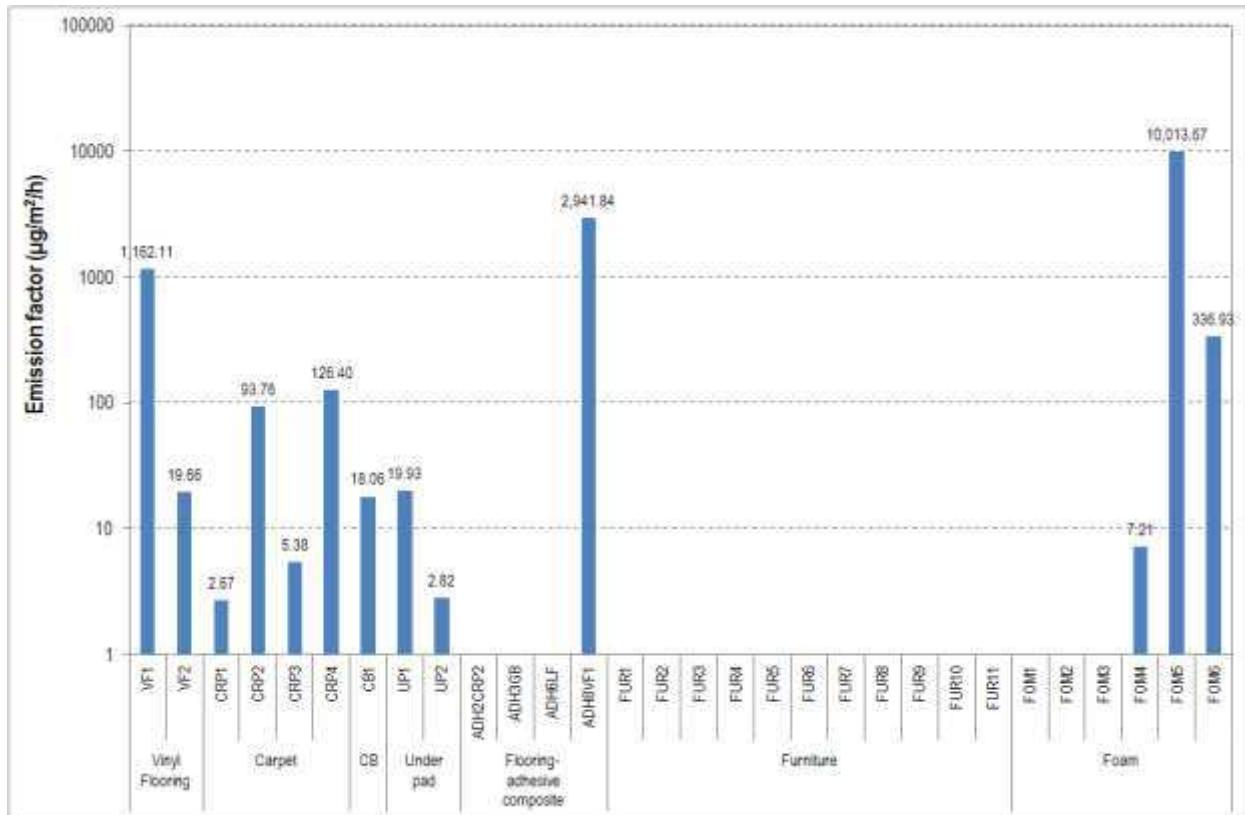


Figure A. 136: Emission factors for solid building materials and furnishings (#49: TXIB)

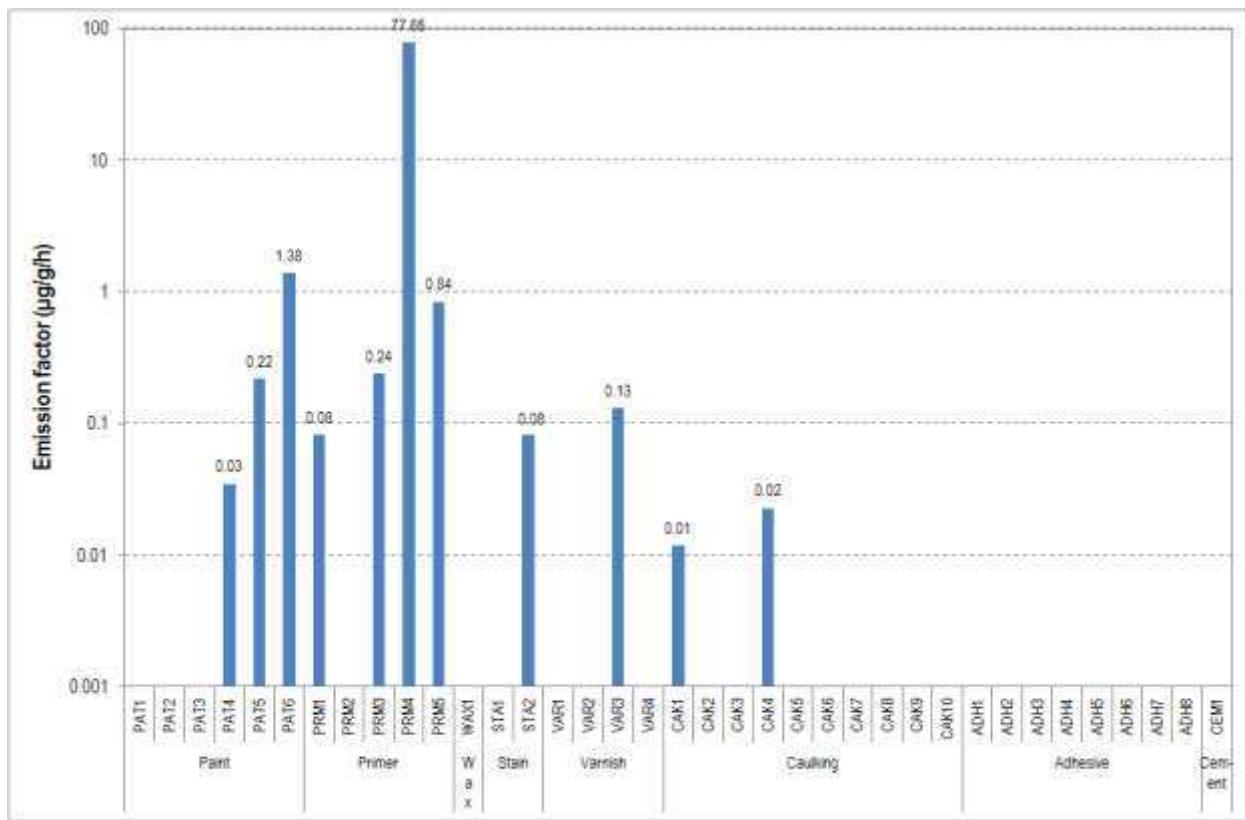


Figure A. 137: Emission factors for liquid building materials (#49: TXIB)

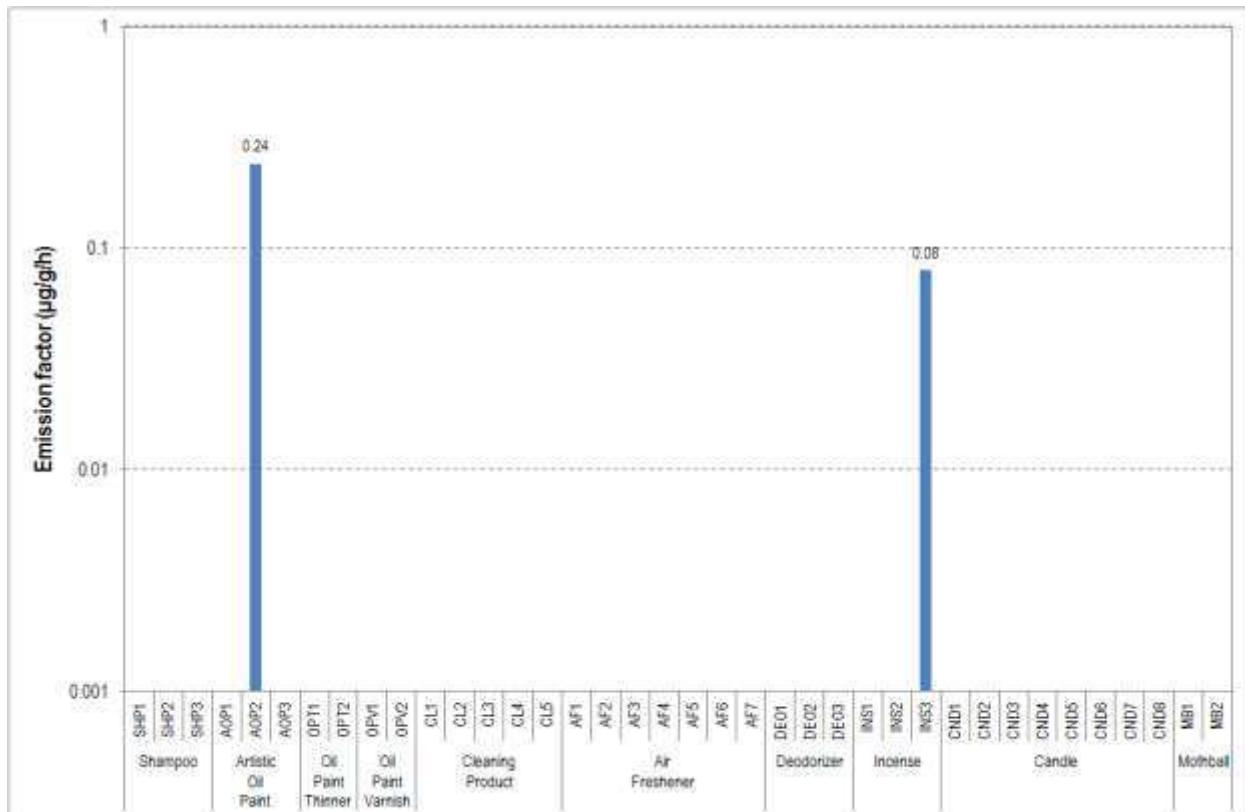


Figure A. 138: Emission factors for consumer/personal-care products (#49: TXIB)

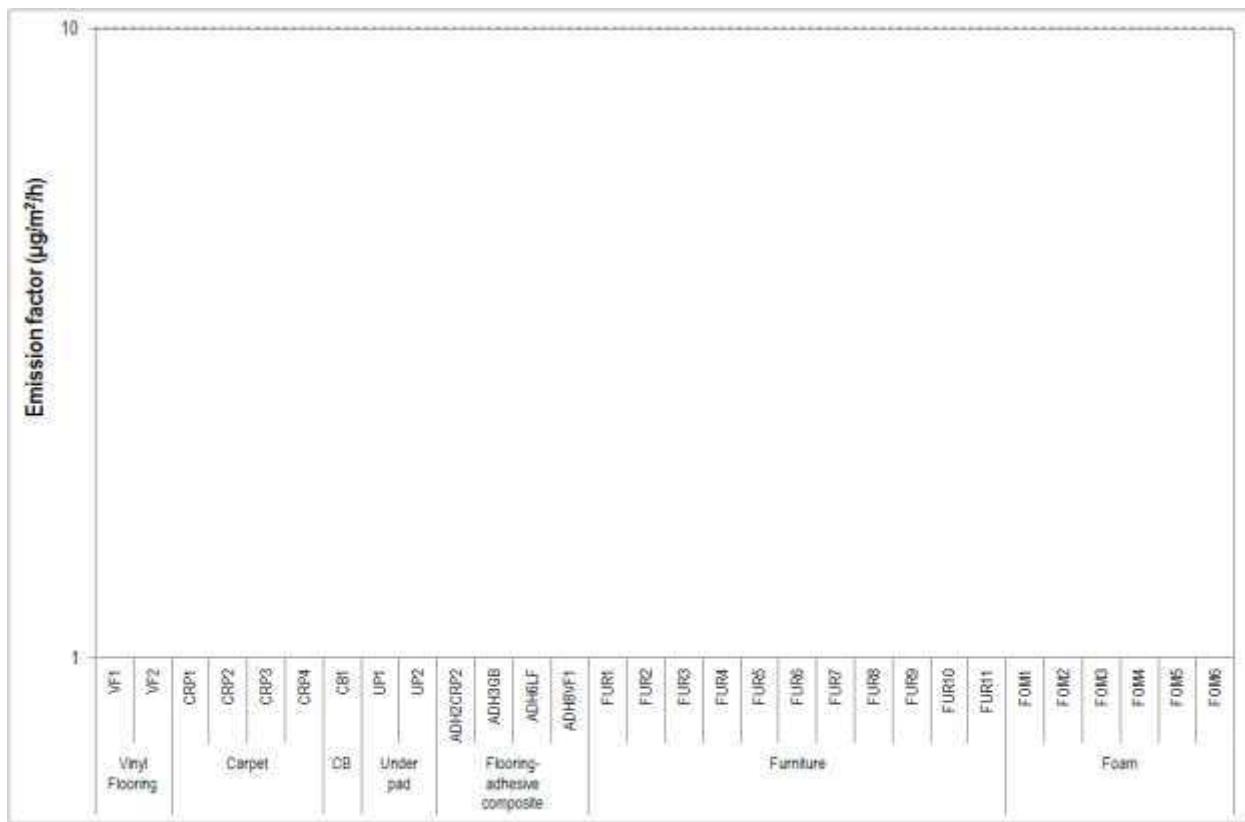


Figure A. 139: Emission factors for solid building materials and furnishings (#50: 1-methoxy-2-propanol)

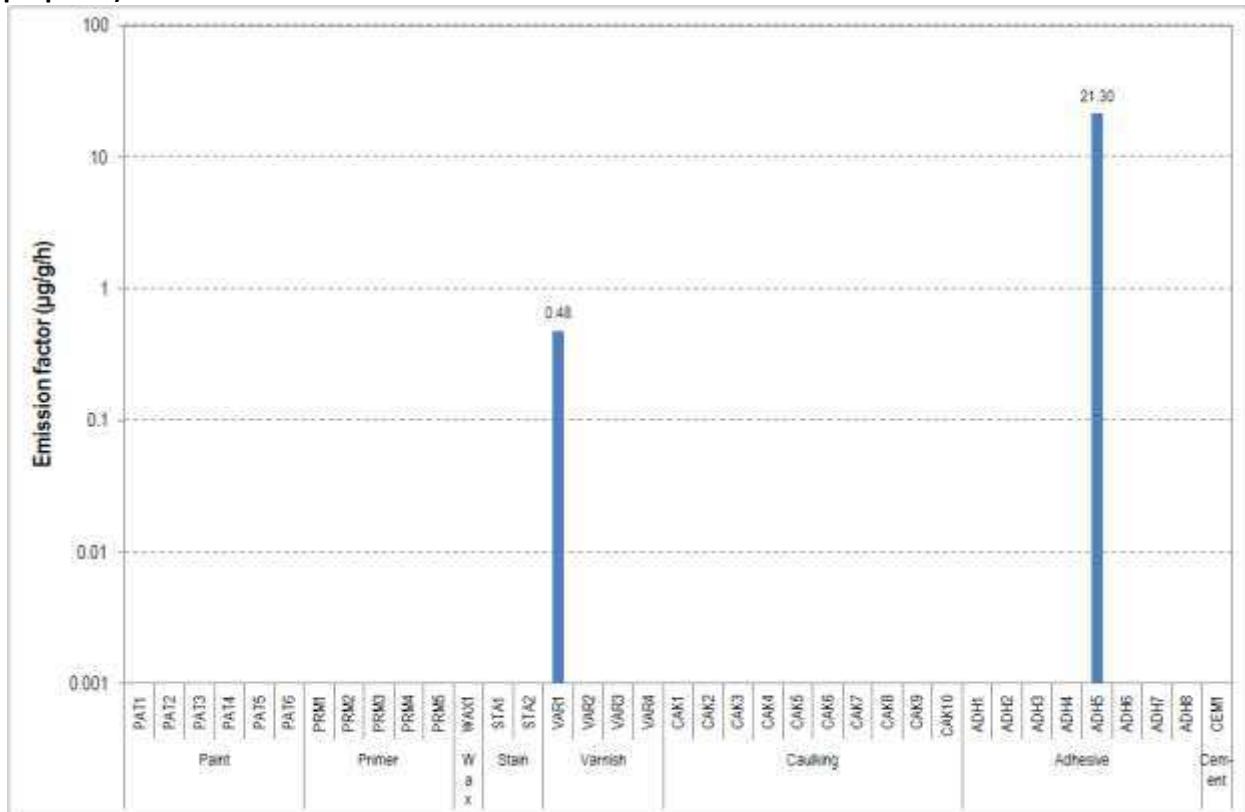


Figure A. 140: Emission factors for liquid building materials (#50: 1-methoxy-2-propanol)

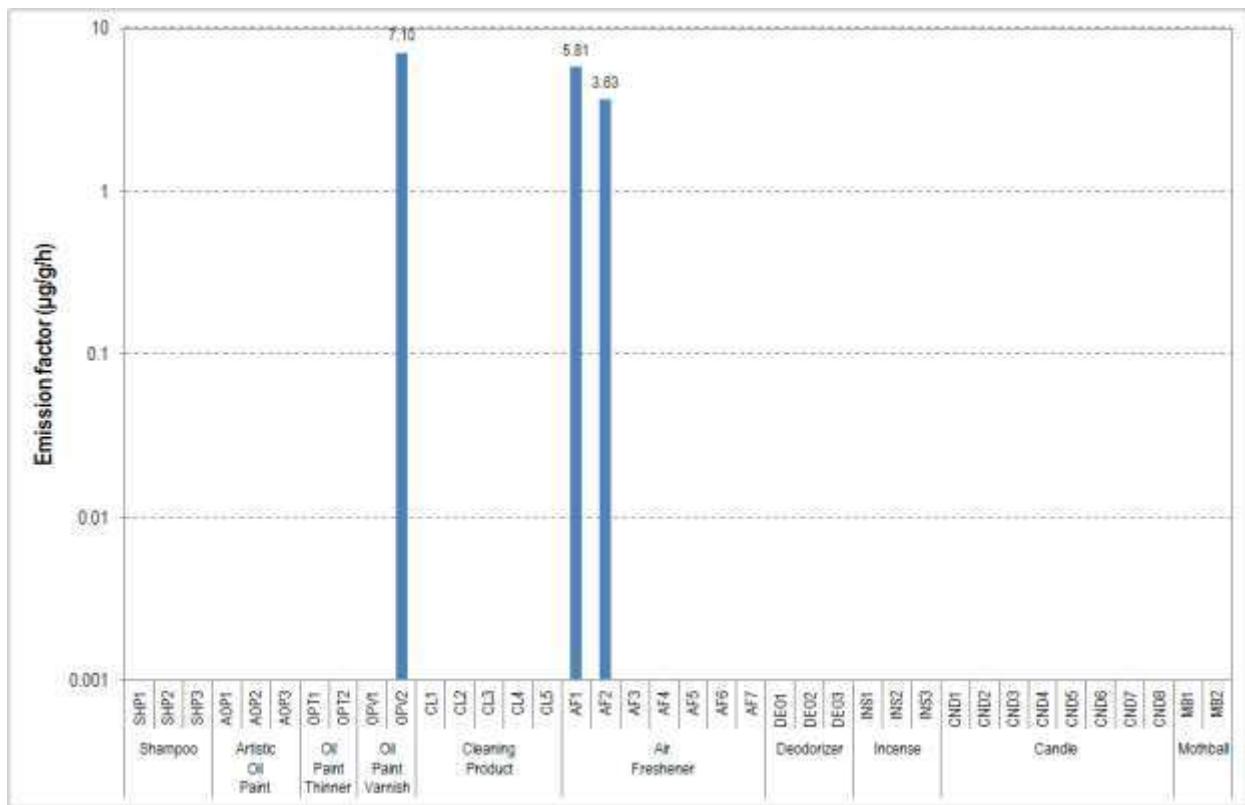


Figure A. 141: Emission factors for consumer/personal-care products (#50: 1-methoxy-2-propanol)

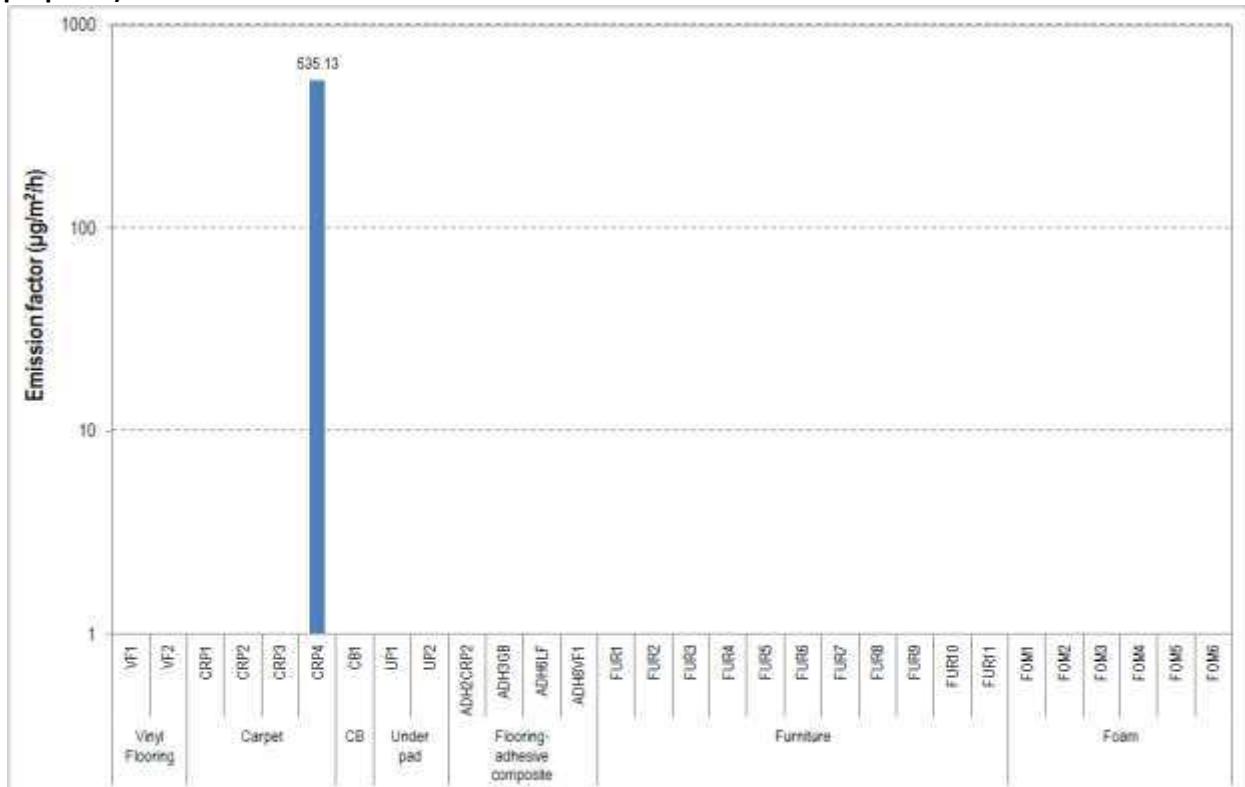


Figure A. 142: Emission factors for solid building materials and furnishings (#51: 2-(2-butoxyethoxy) ethanol)

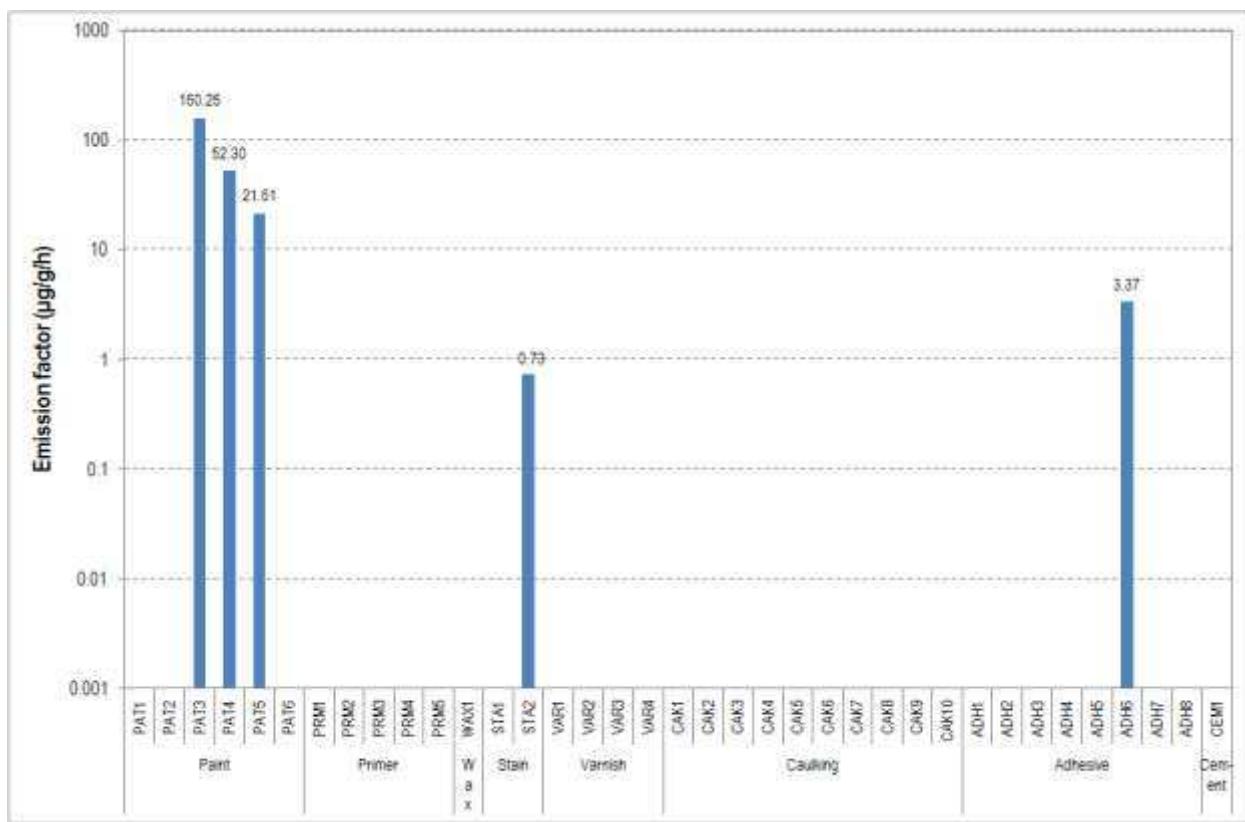


Figure A. 143: Emission factors for liquid building materials (#51: 2-(2-butoxyethoxy) ethanol)

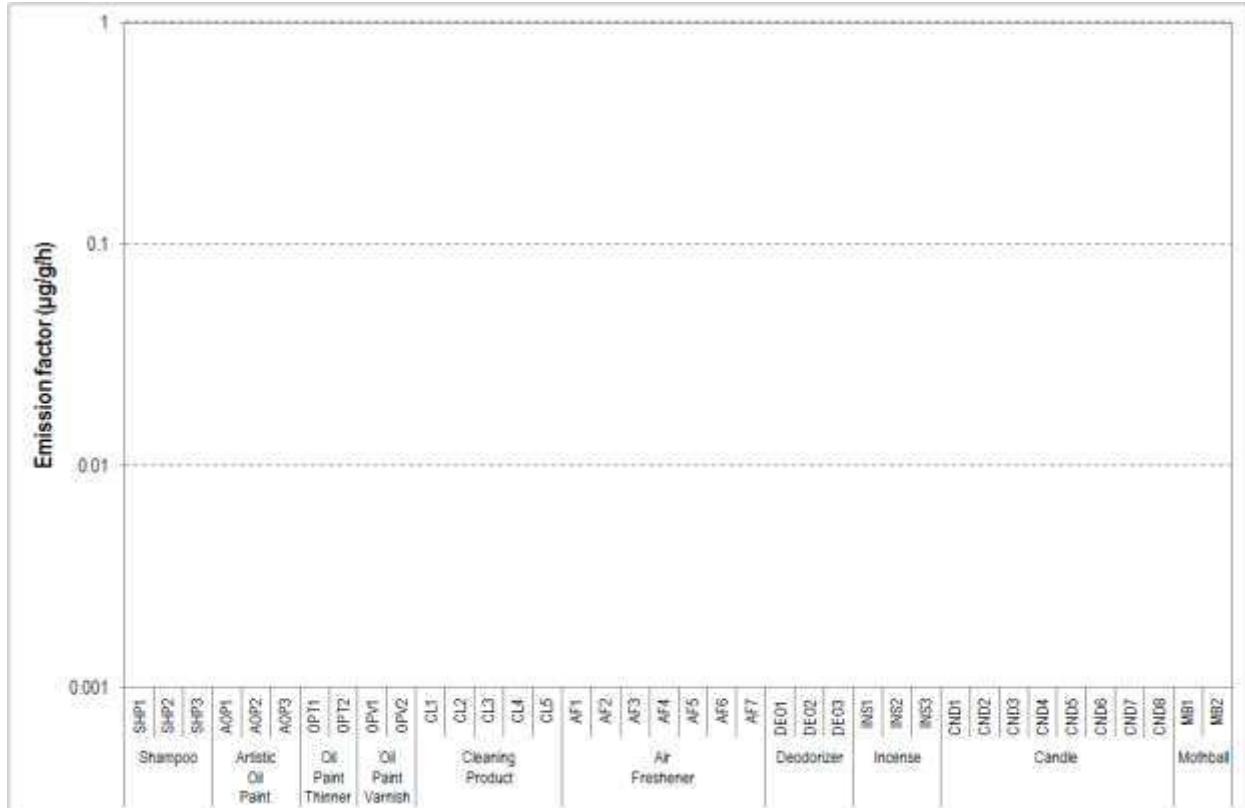


Figure A. 144: Emission factors for consumer/personal-care products (#51: 2-(2-butoxyethoxy) ethanol)

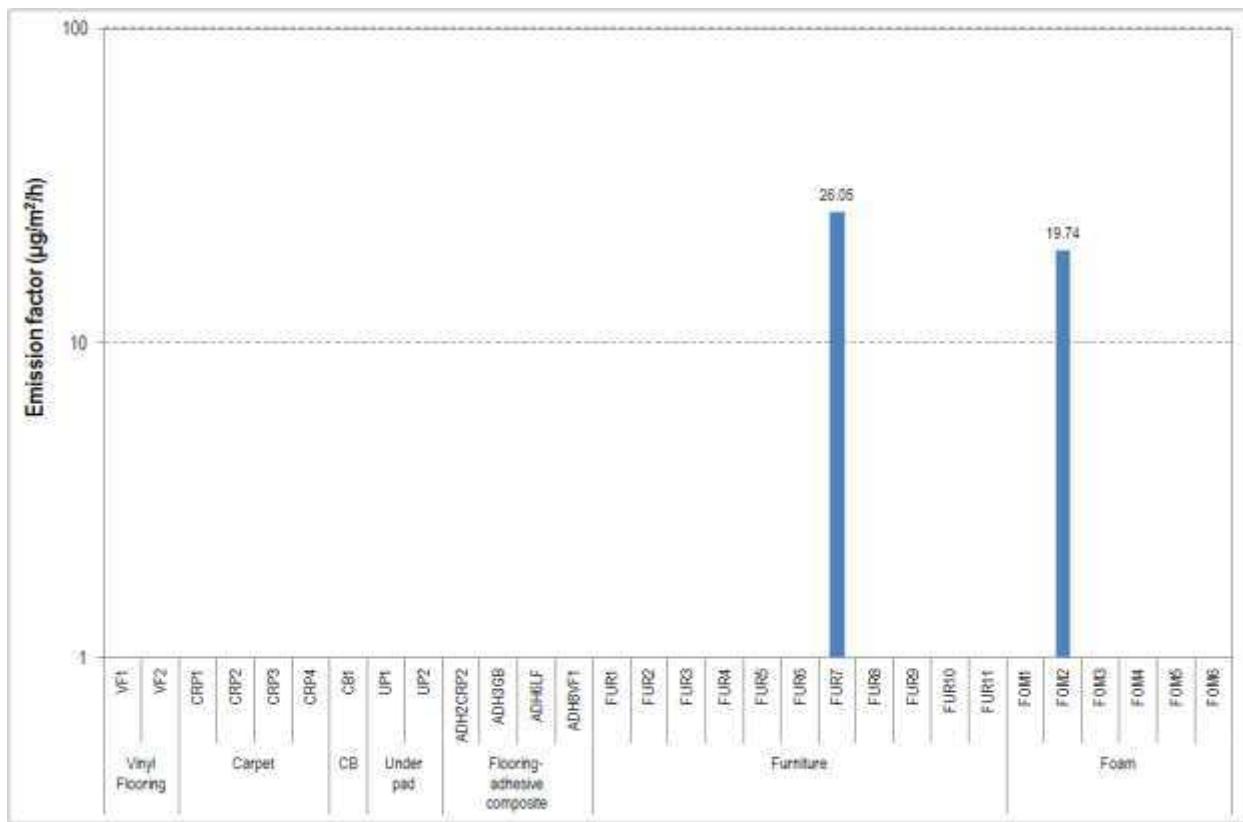


Figure A. 145: Emission factors for solid building materials and furnishings (#52: 2-butoxyethanol)

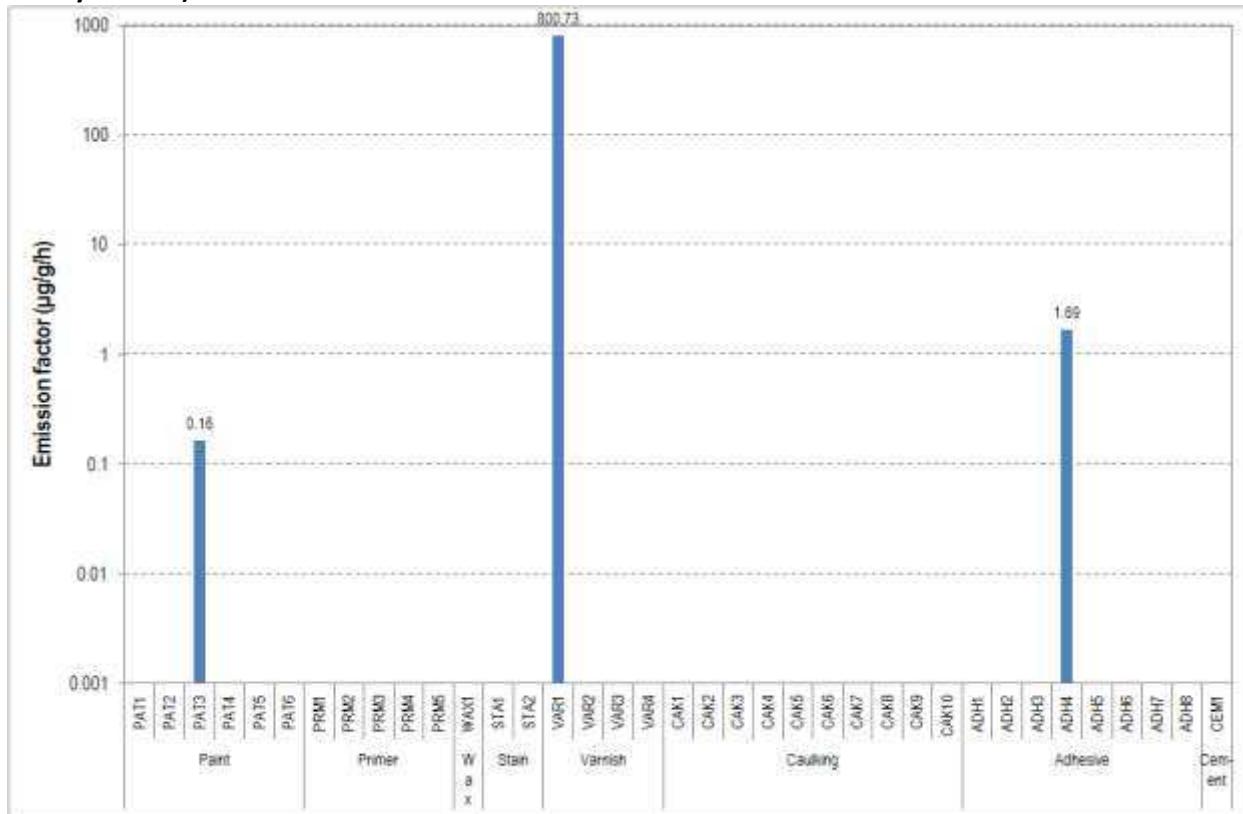


Figure A. 146: Emission factors for liquid building materials (#52: 2-butoxyethanol)

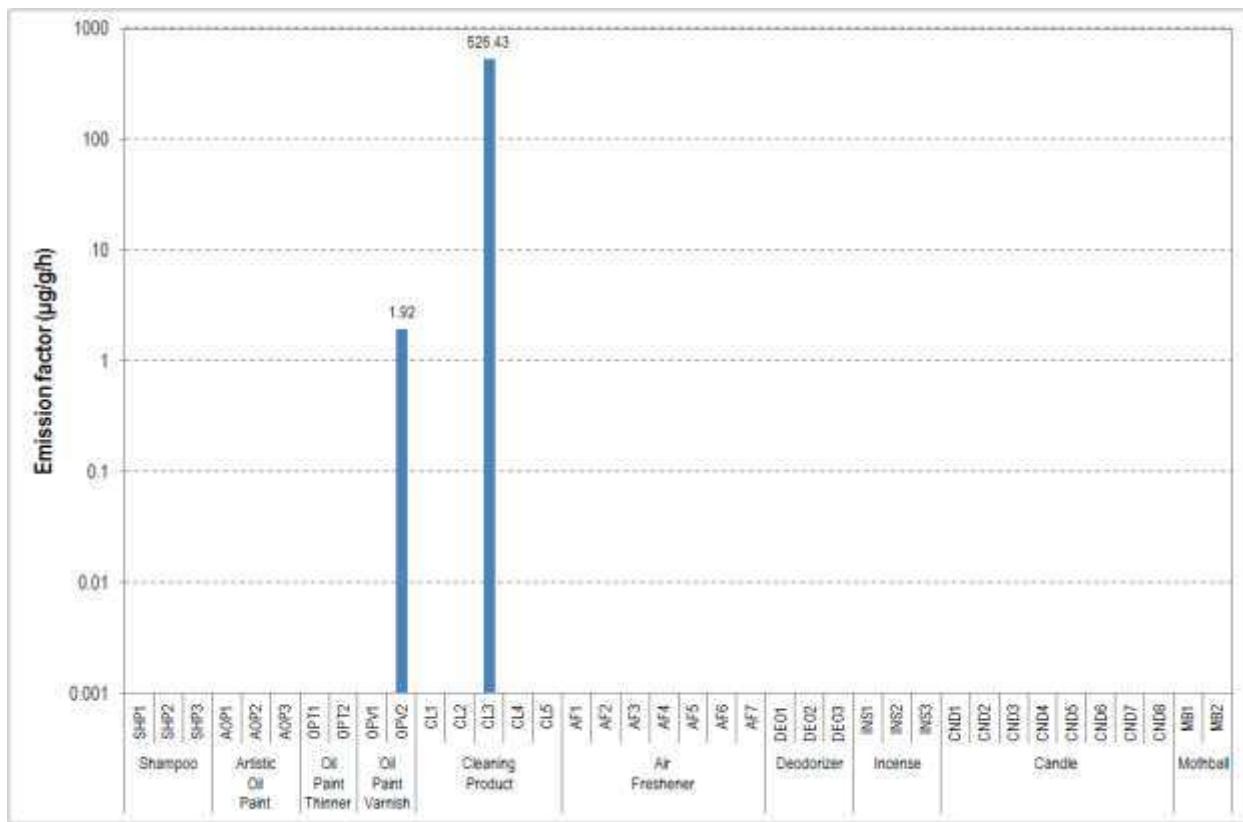


Figure A. 147: Emission factors for consumer/personal-care products (#52: 2-butoxyethanol)

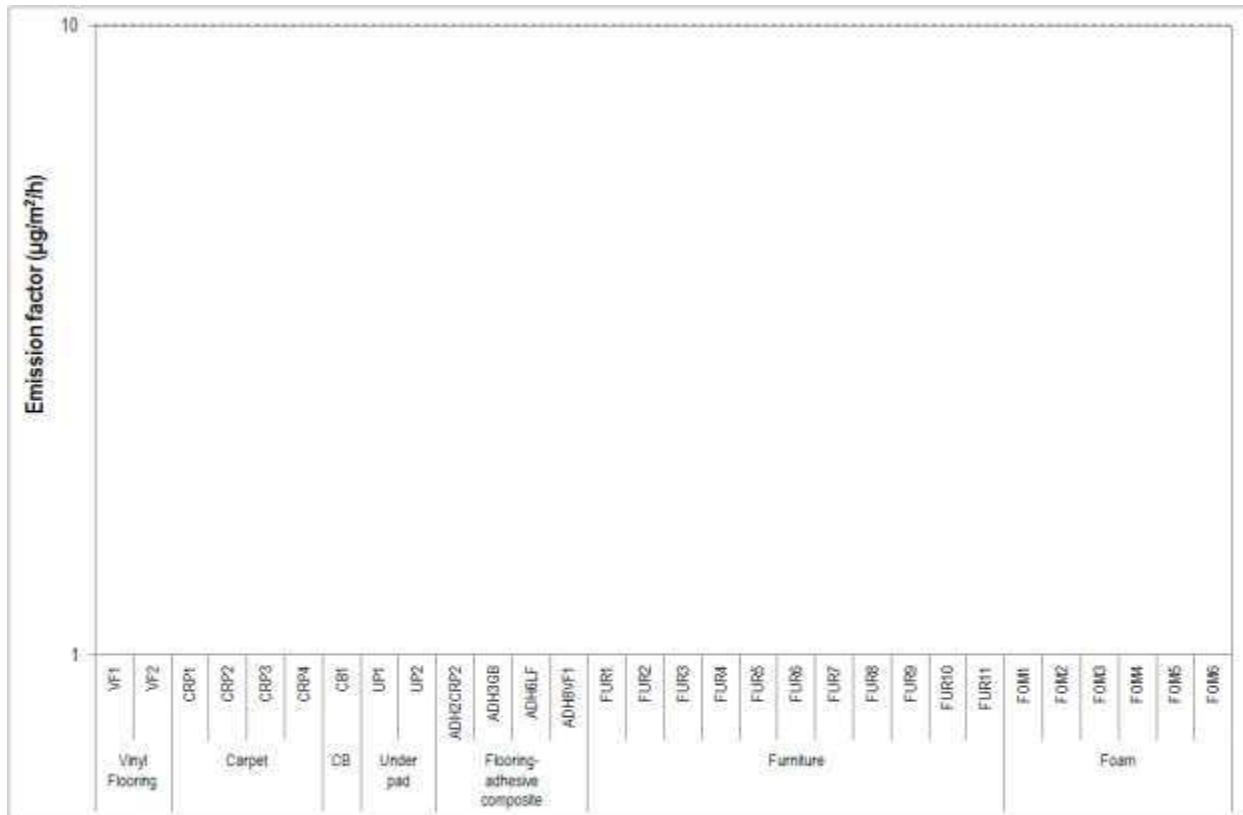


Figure A. 148: Emission factors for solid building materials and furnishings (#53: 2-ethoxyethanol)

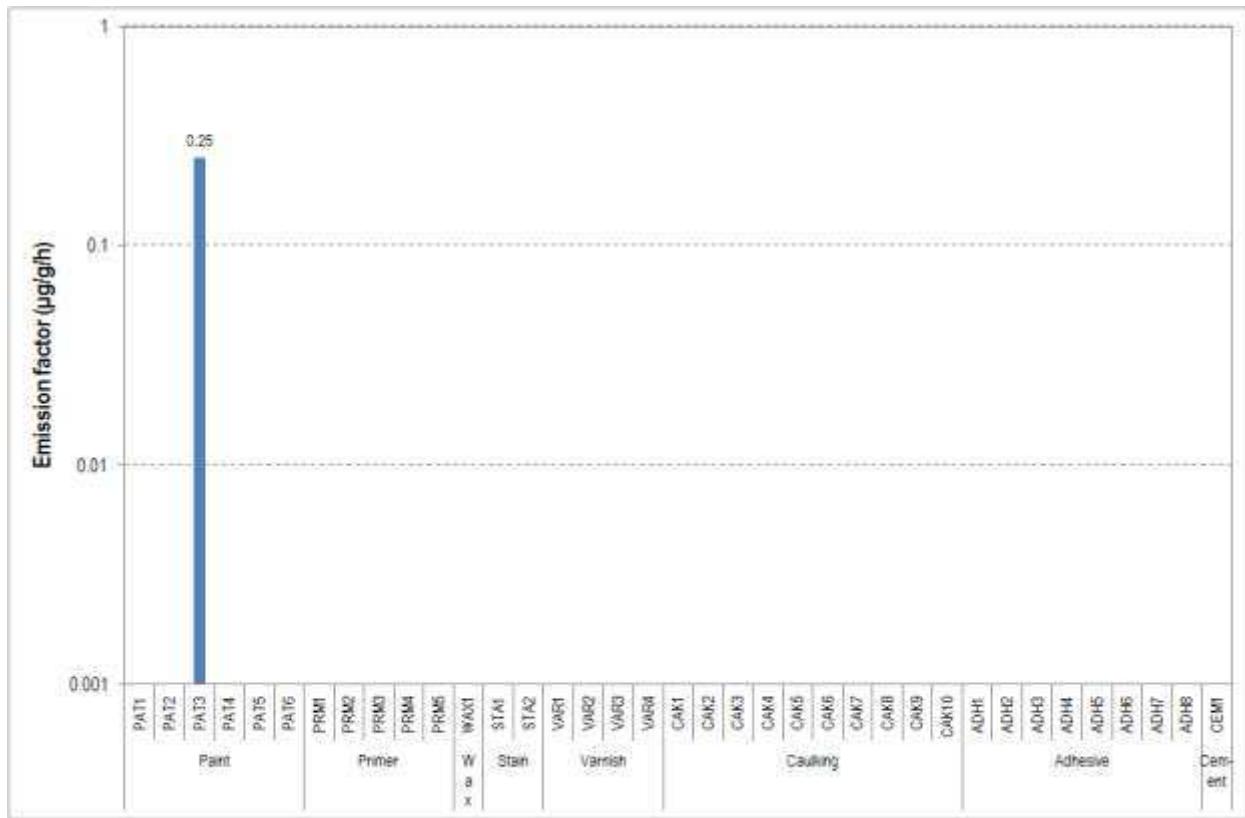


Figure A. 149: Emission factors for liquid building materials (#53: 2-ethoxyethanol)

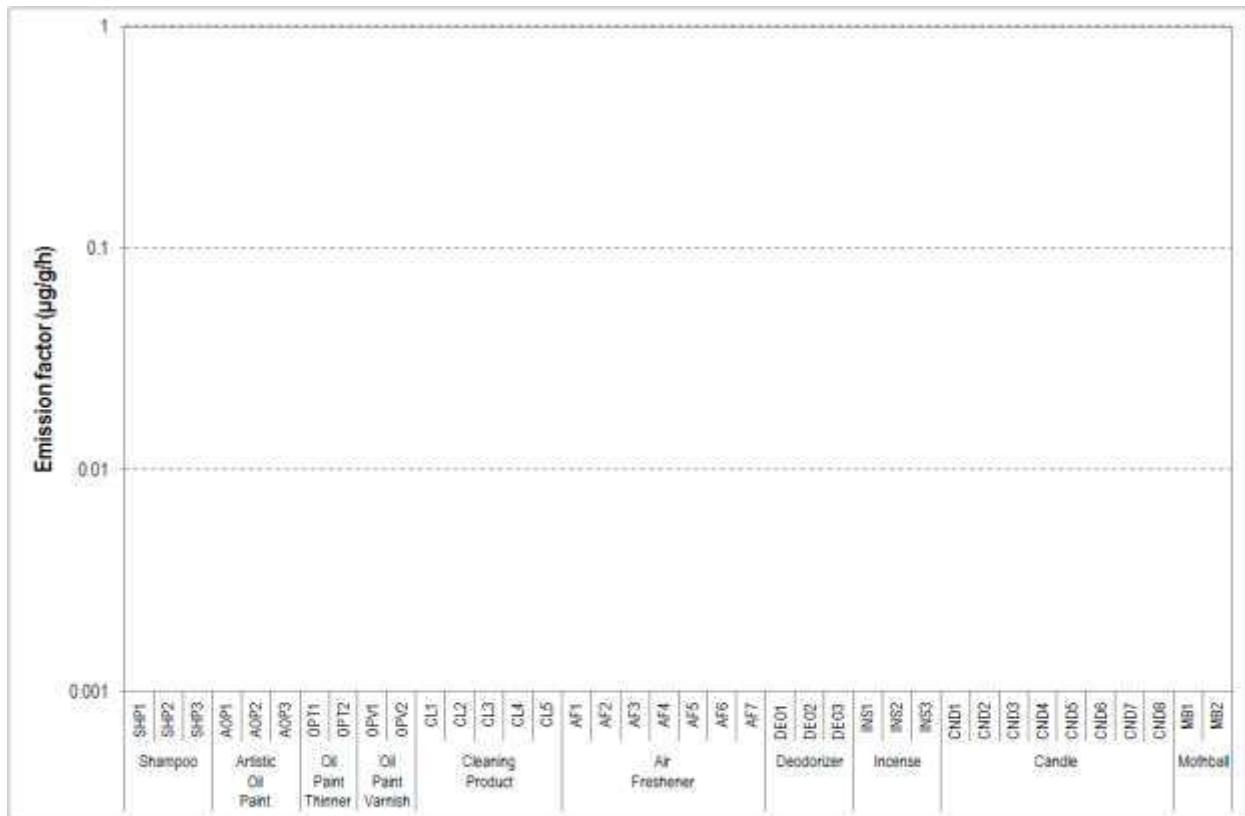


Figure A. 150: Emission factors for consumer/personal-care products (#53: 2-ethoxyethanol)

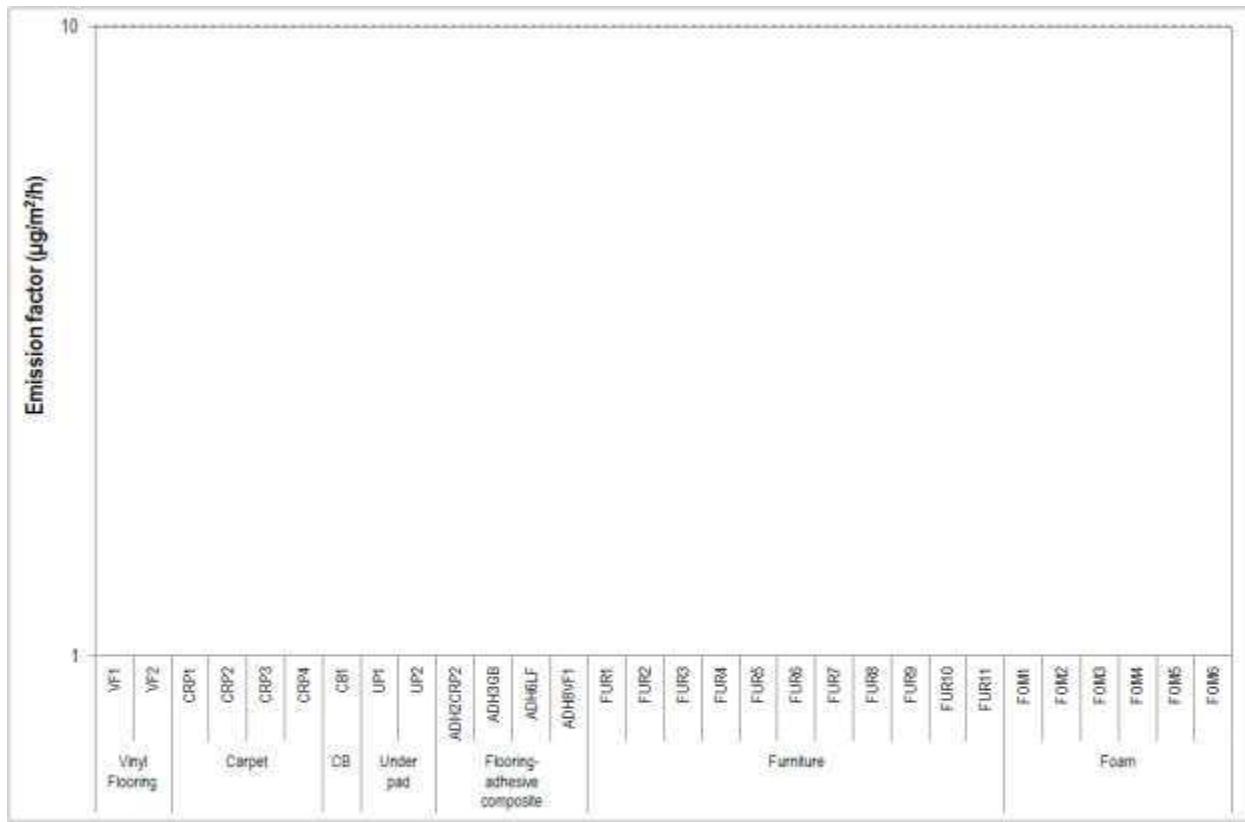


Figure A. 151: Emission factors for solid building materials and furnishings (#54: 2-methoxyethanol)

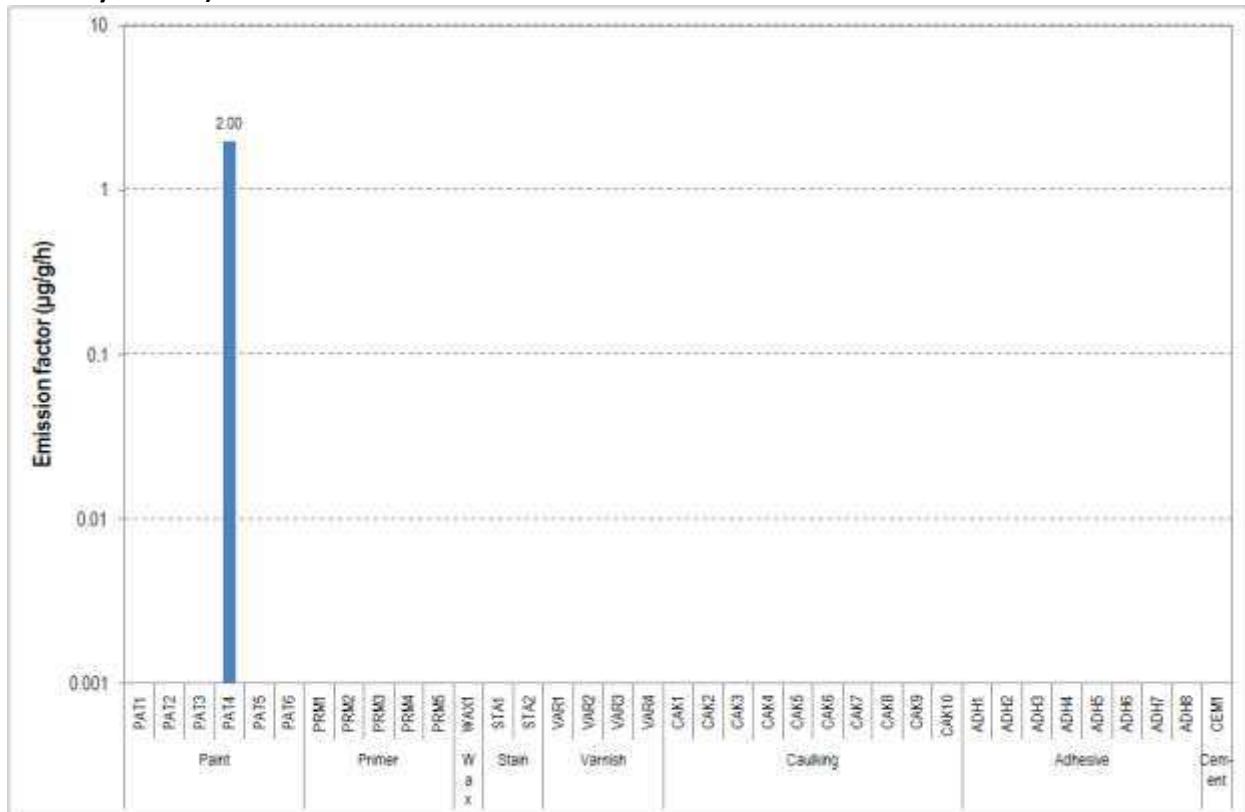


Figure A. 152: Emission factors for liquid building materials (#54: 2-methoxyethanol)

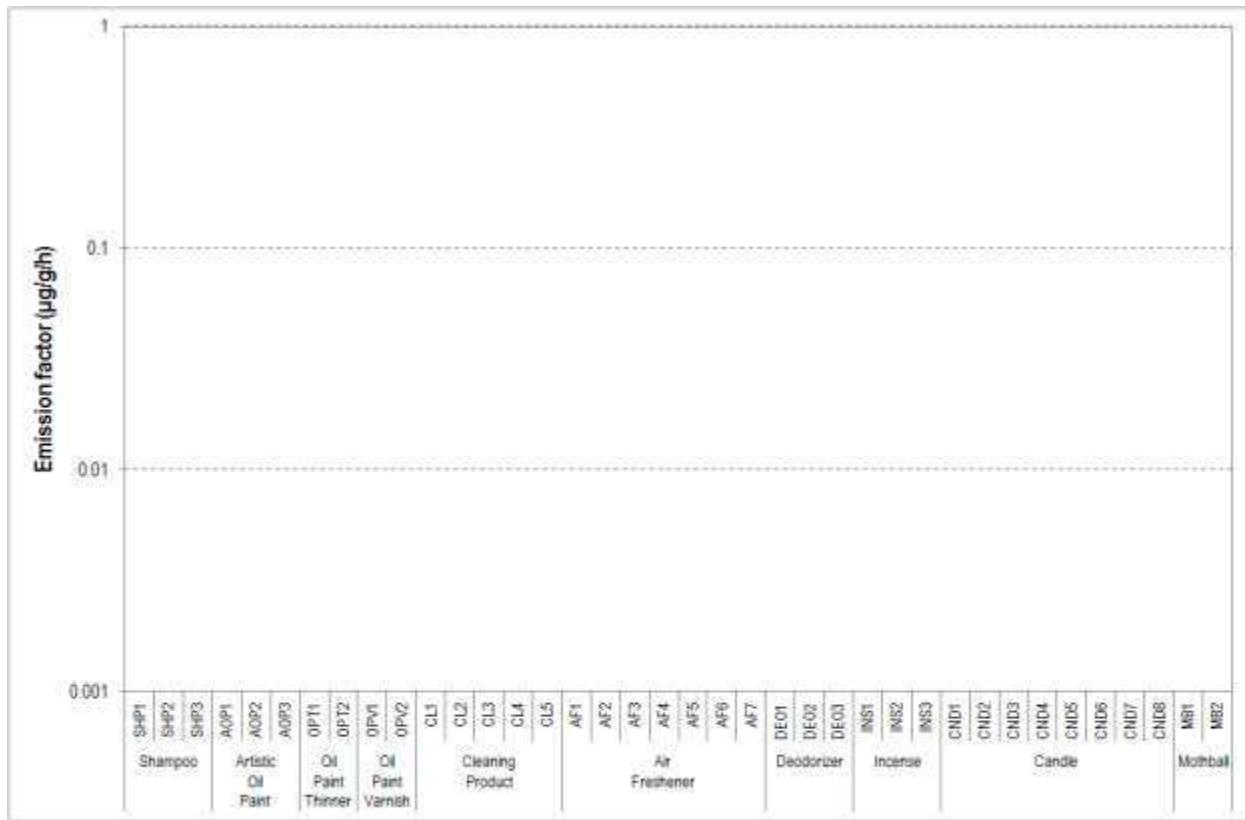


Figure A. 153: Emission factors for consumer/personal-care products (#54: 2-methoxyethanol)

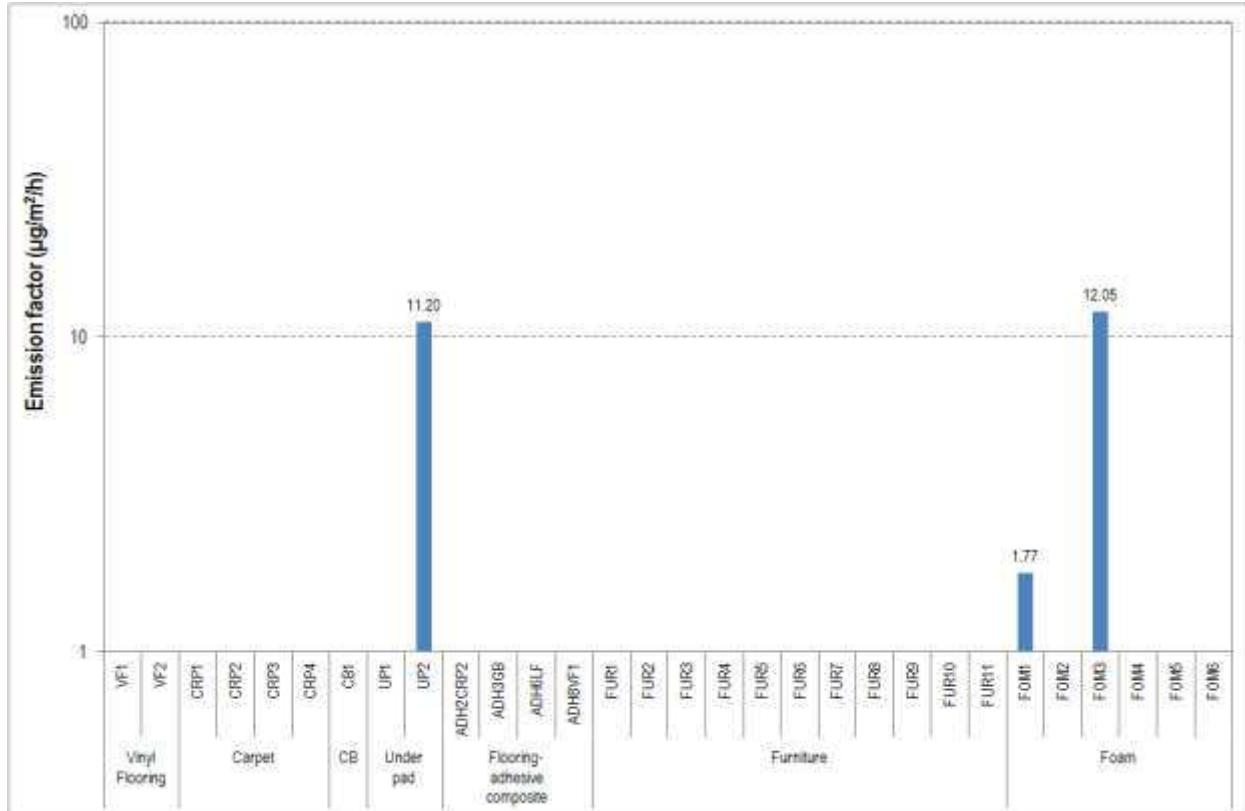


Figure A. 154: Emission factors for solid building materials and furnishings (#57: 1,2-dichlorobenzene)

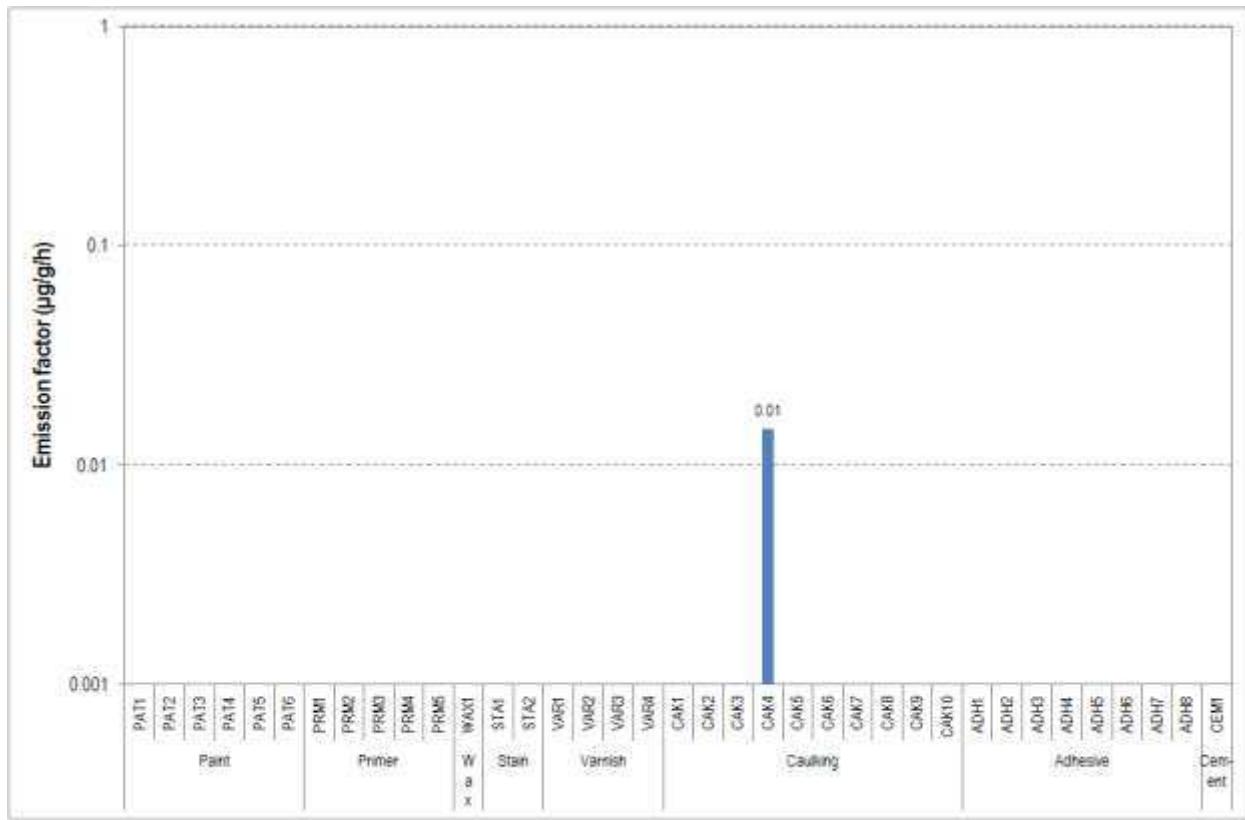


Figure A. 155: Emission factors for liquid building materials (#57: 1,2-dichlorobenzene)

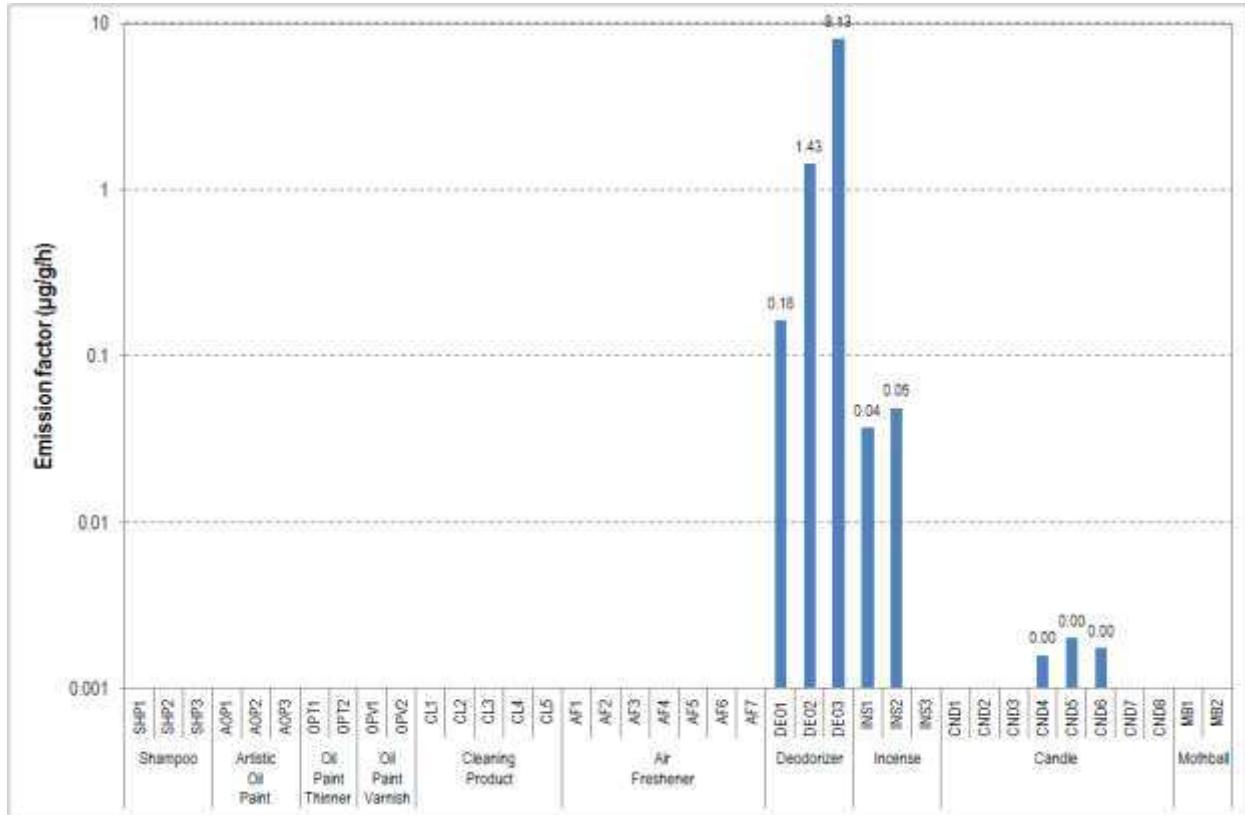


Figure A. 156: Emission factors for consumer/personal-care products (#57: 1,2-dichlorobenzene)

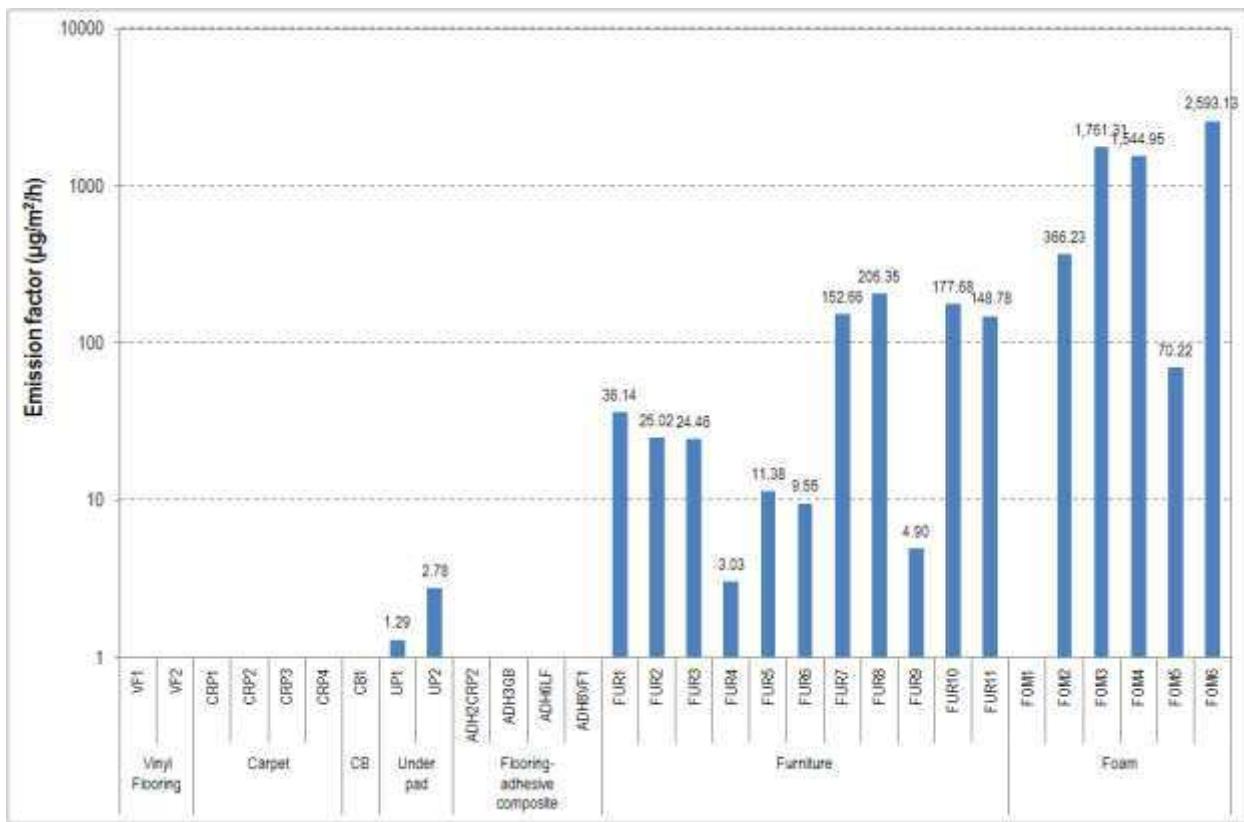


Figure A. 157: Emission factors for solid building materials and furnishings (#60: 1,4-dichlorobenzene)

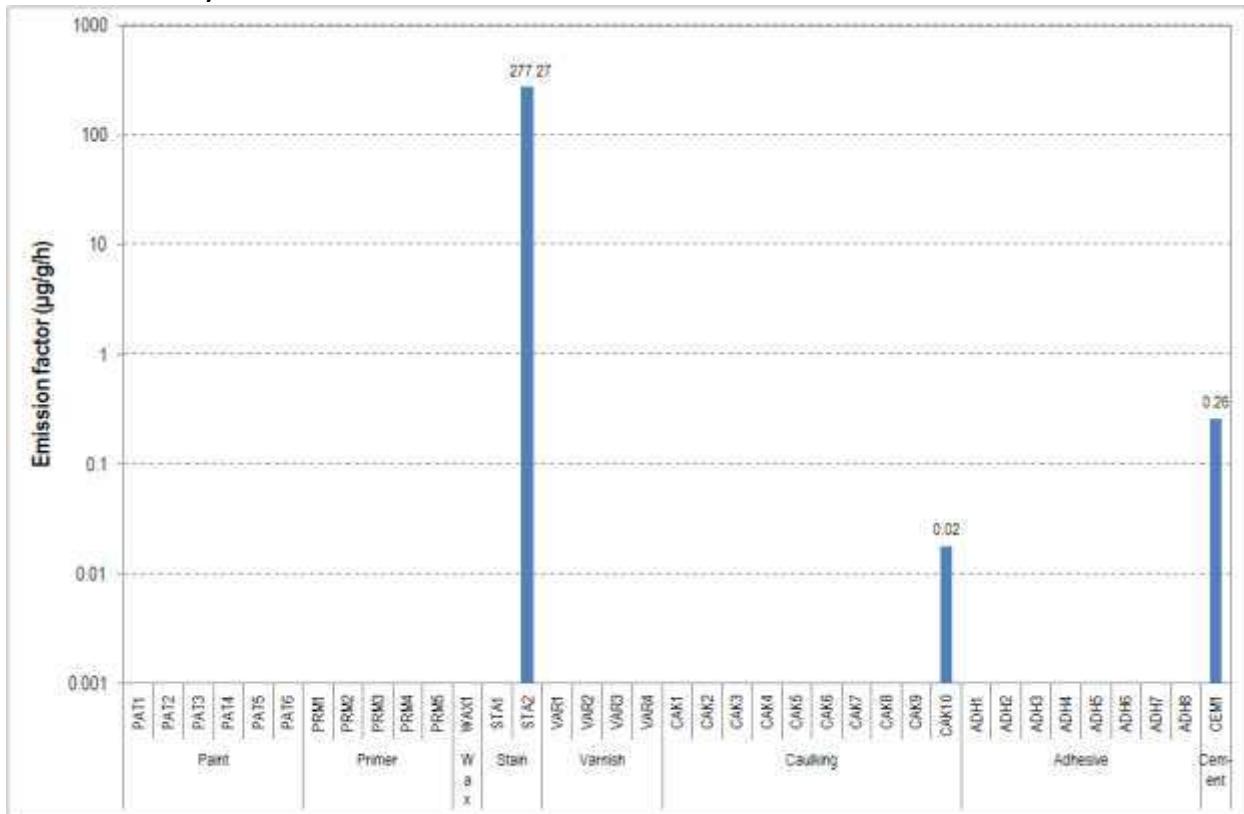


Figure A. 158: Emission factors for liquid building materials (#60: 1,4-dichlorobenzene)

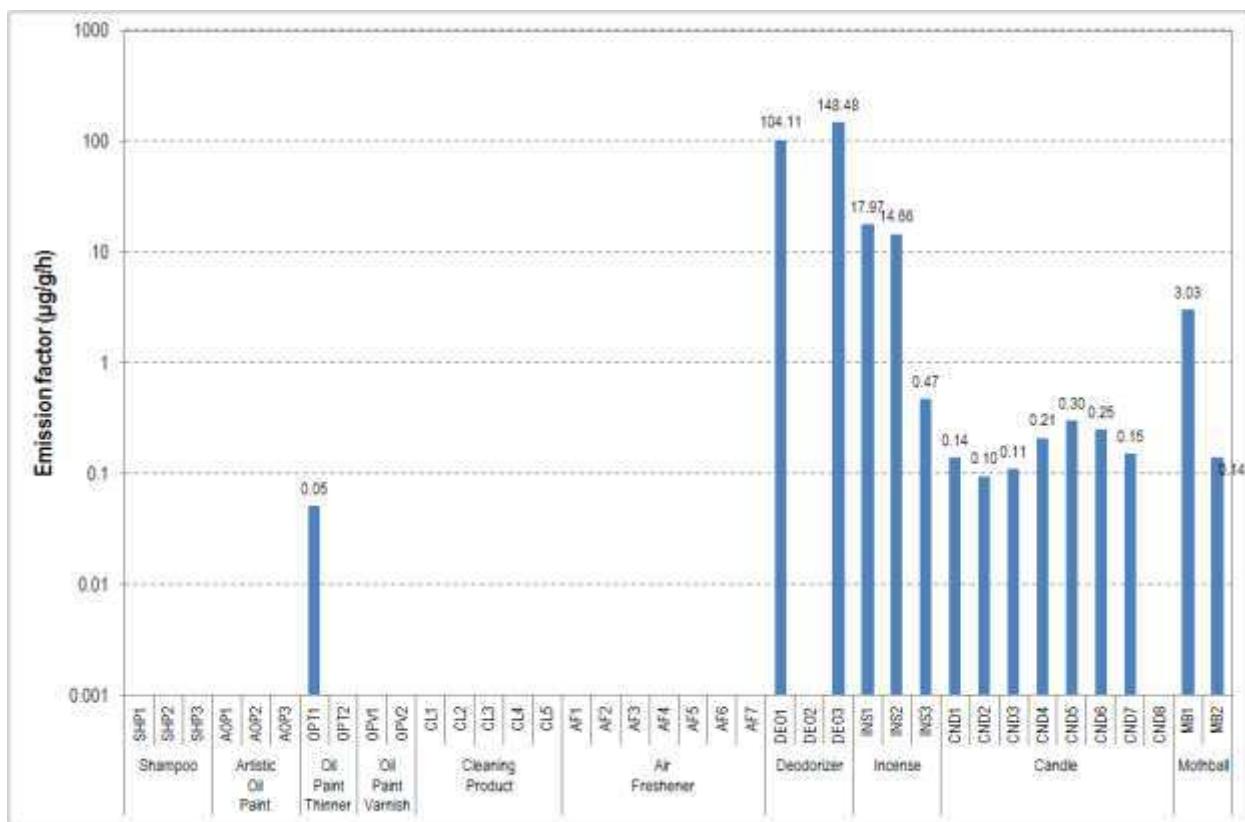


Figure A. 159: Emission factors for consumer/personal-care products (#60: 1,4-dichlorobenzene)

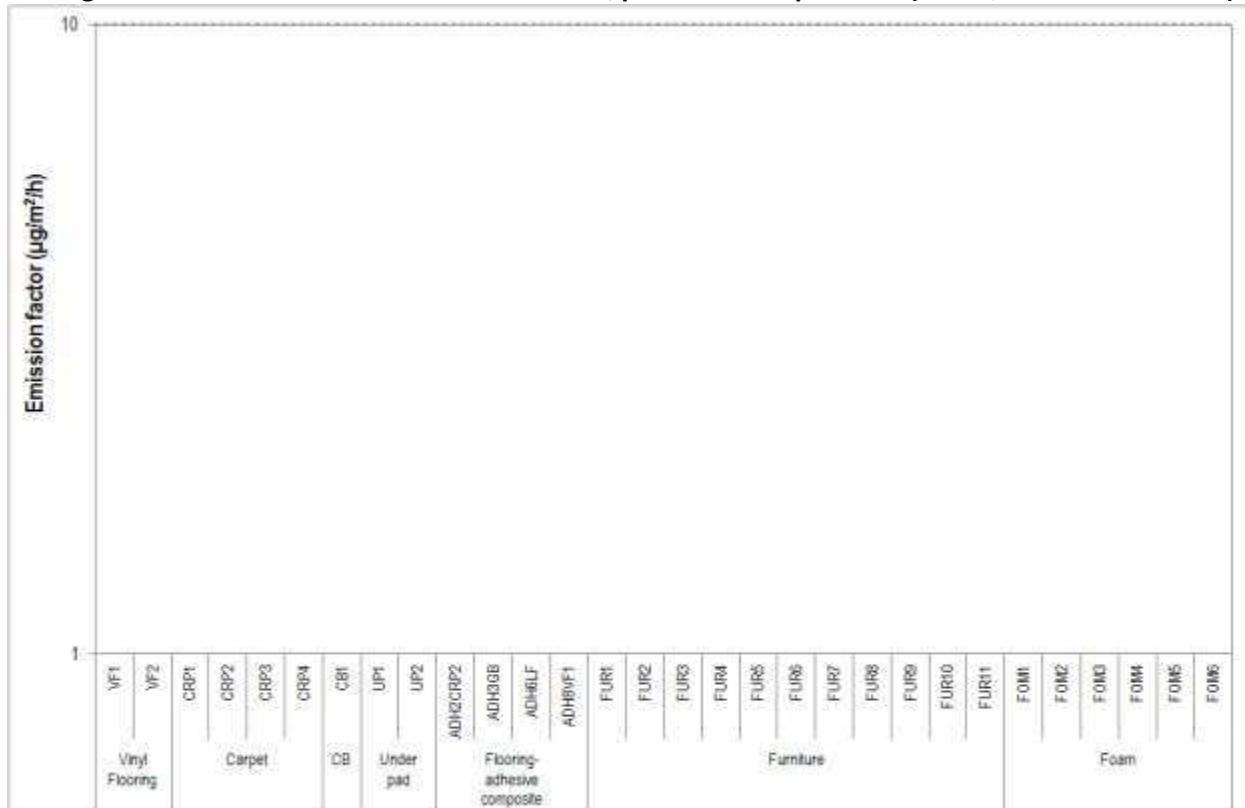


Figure A. 160: Emission factors for solid building materials and furnishings (#62: carbon tetrachloride)

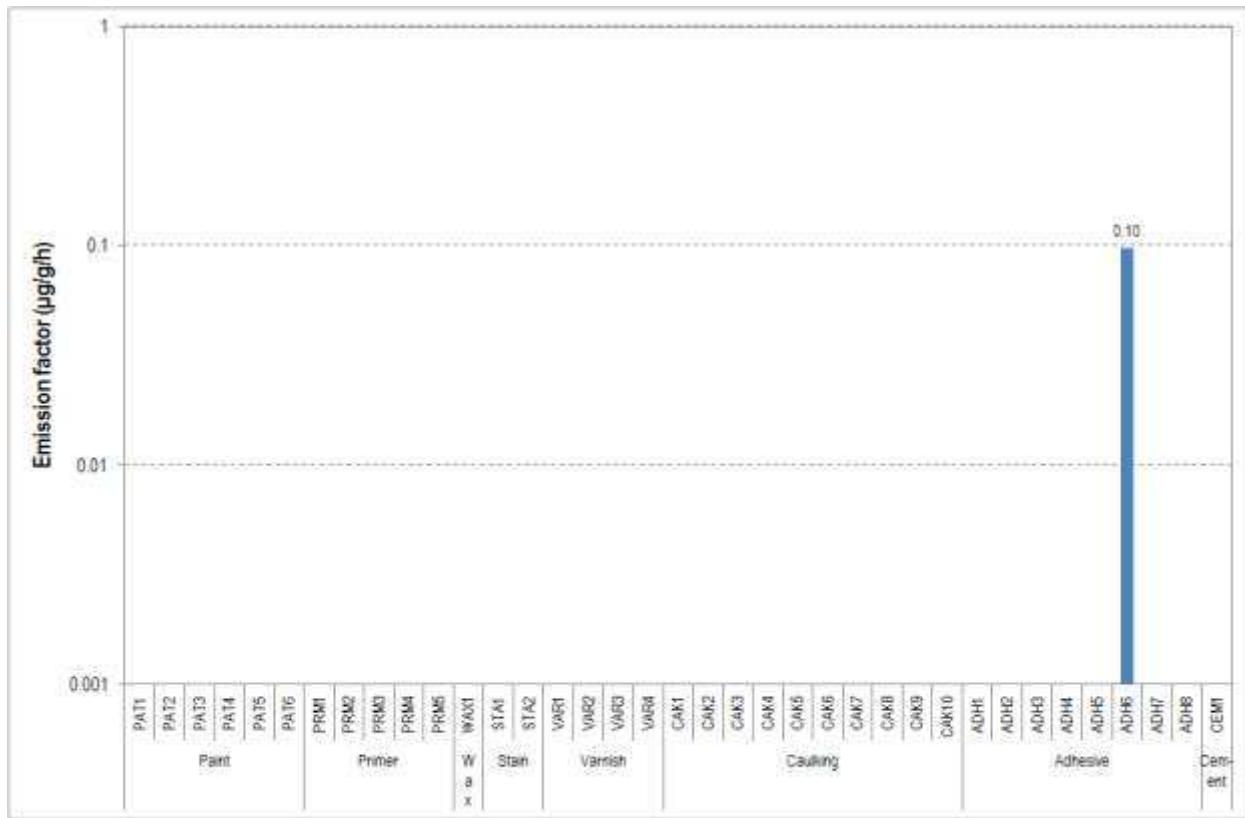


Figure A. 161: Emission factors for liquid building materials (#62: carbon tetrachloride)

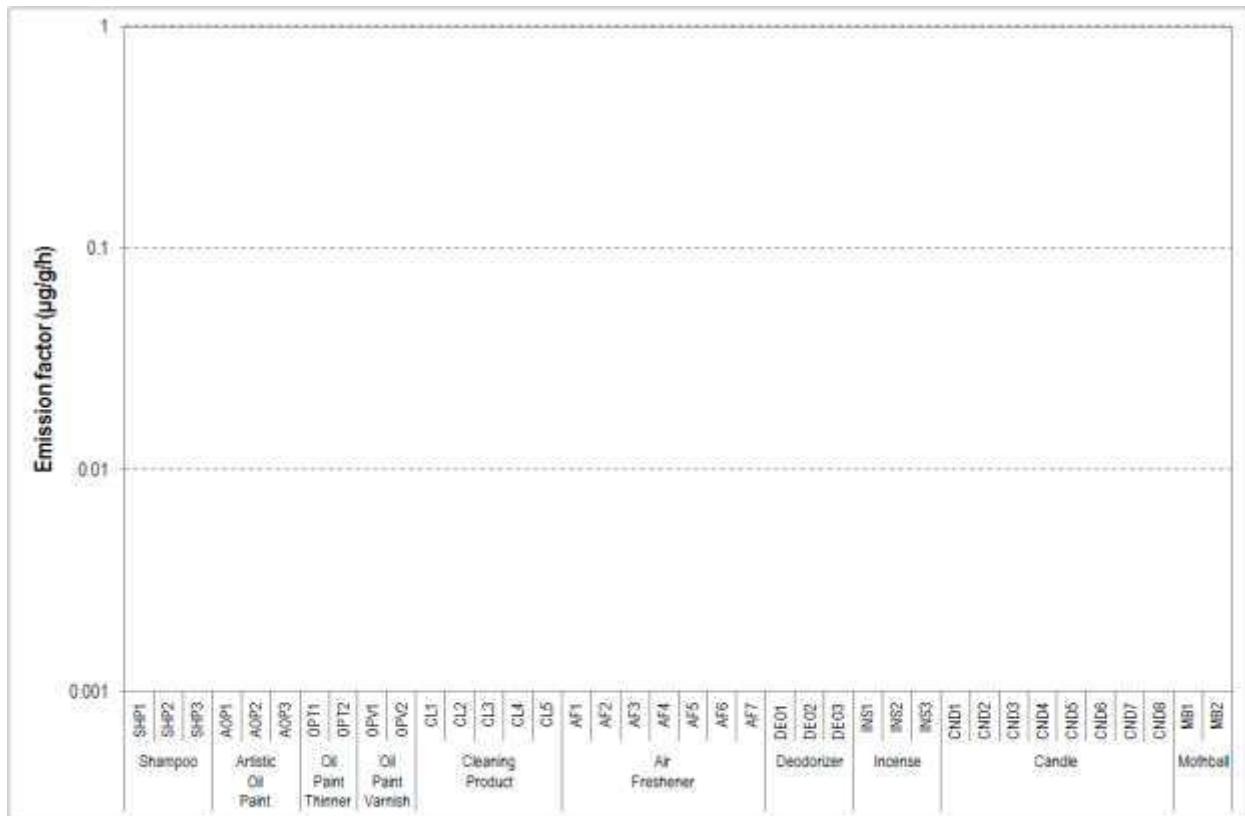


Figure A. 162: Emission factors for consumer/personal-care products (#62: carbon tetrachloride)

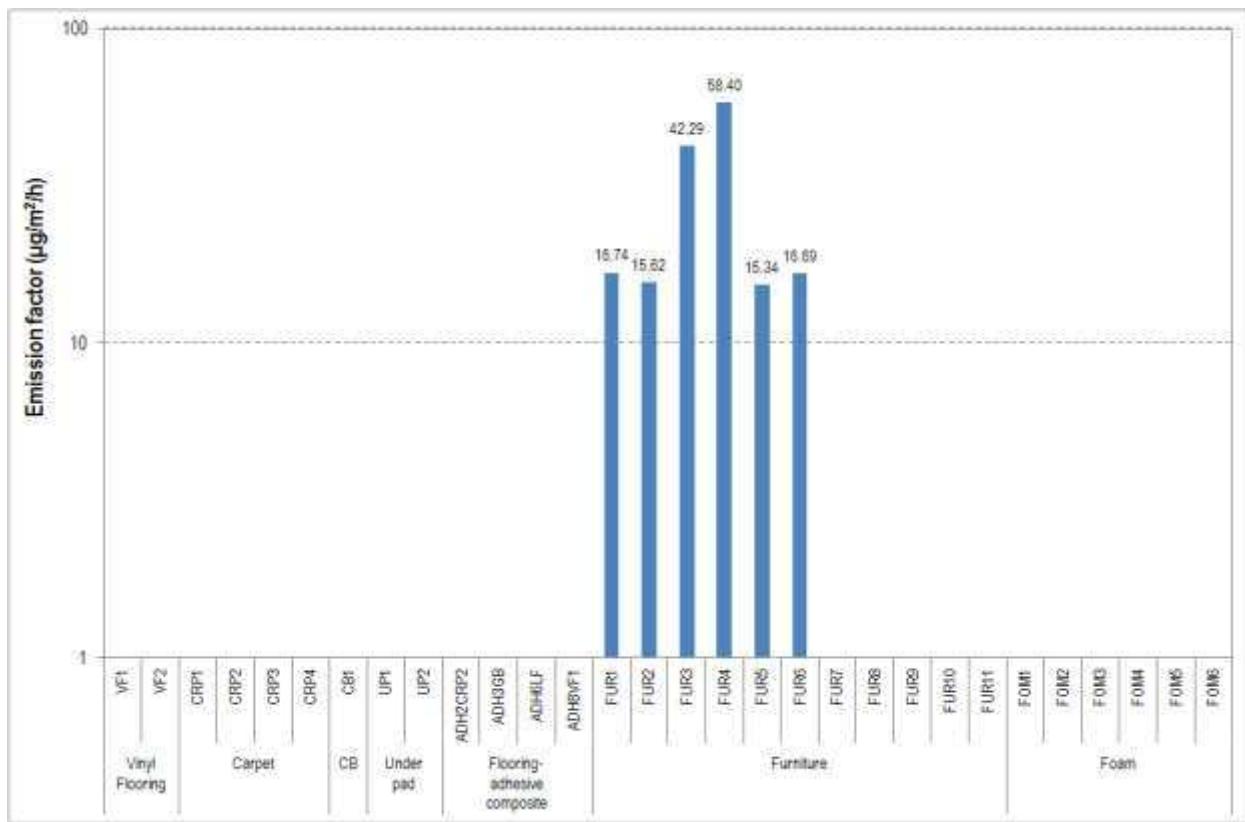


Figure A. 163: Emission factors for solid building materials and furnishings (#64: dichloromethane)

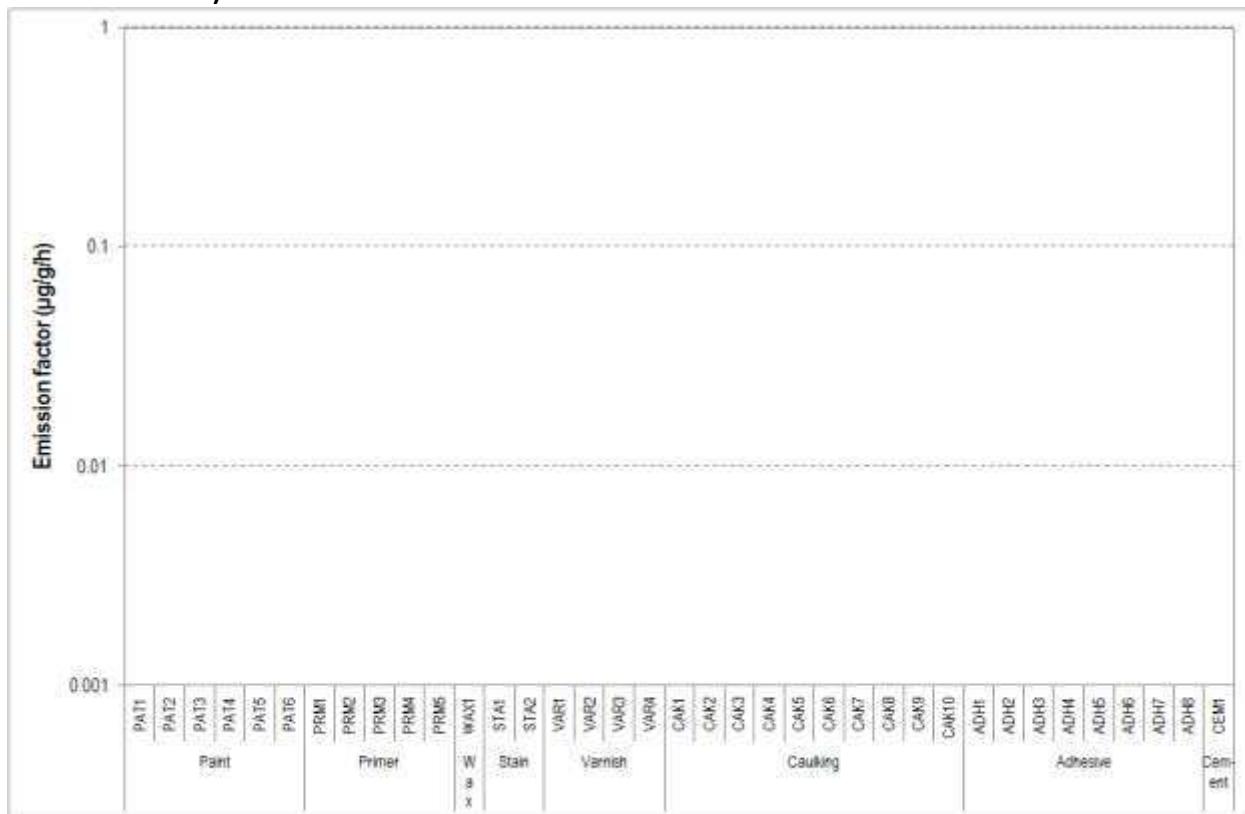


Figure A. 164: Emission factors for liquid building materials (#64: dichloromethane)

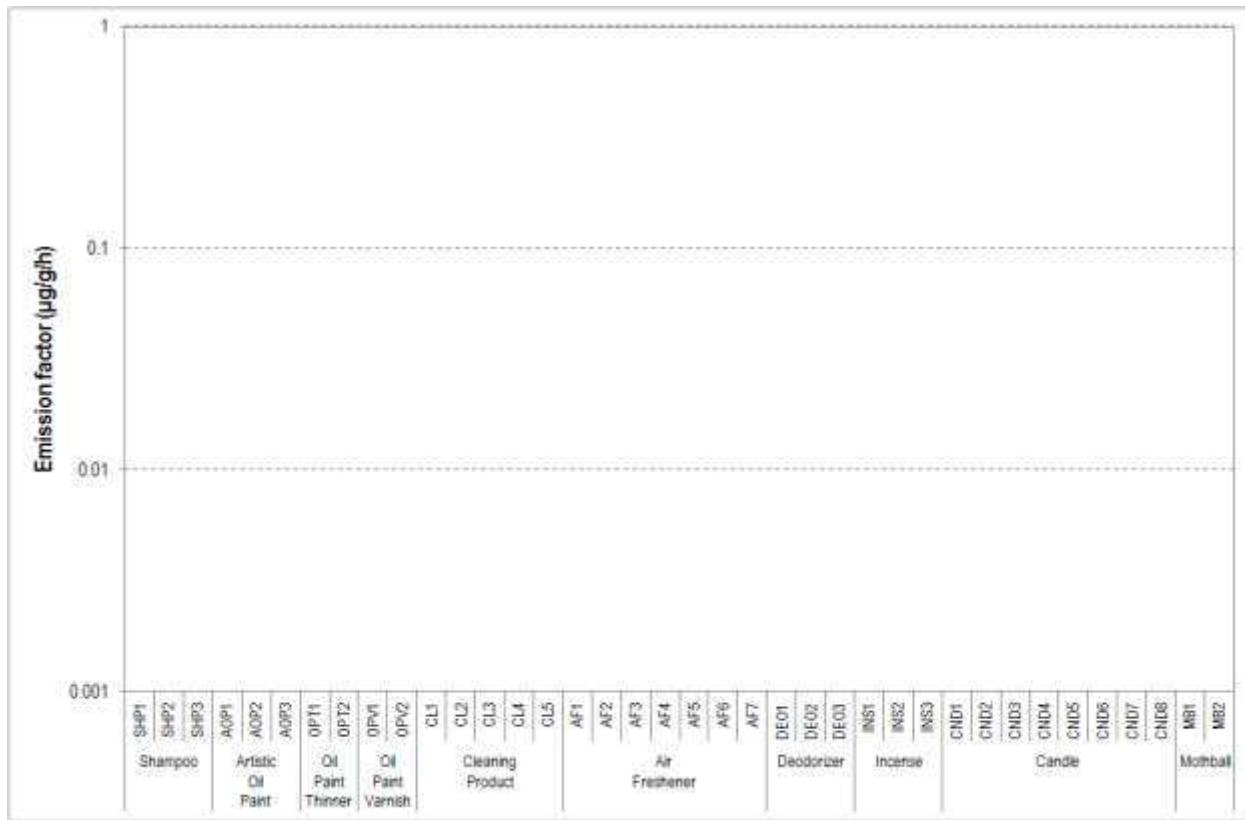


Figure A. 165: Emission factors for consumer/personal-care products (#64: dichloromethane)

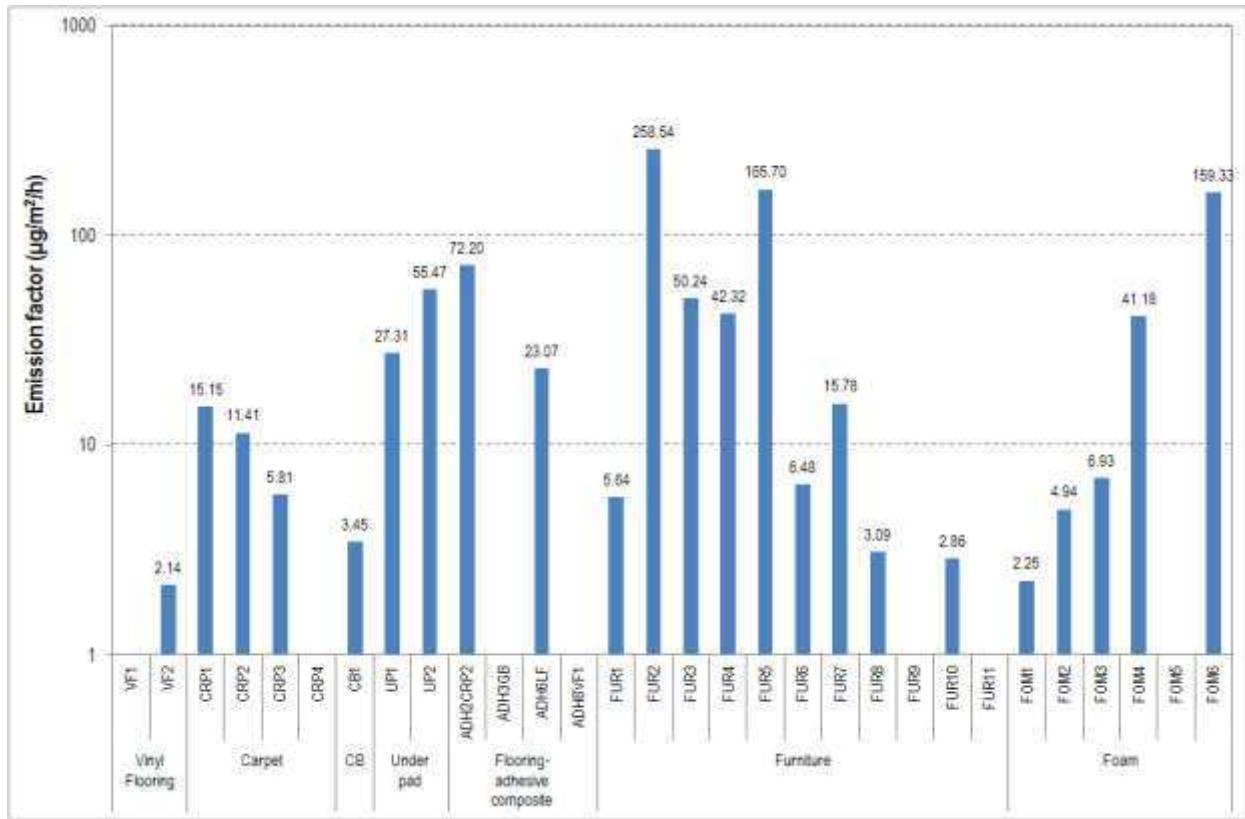


Figure A. 166: Emission factors for solid building materials and furnishings (#68: α -pinene)

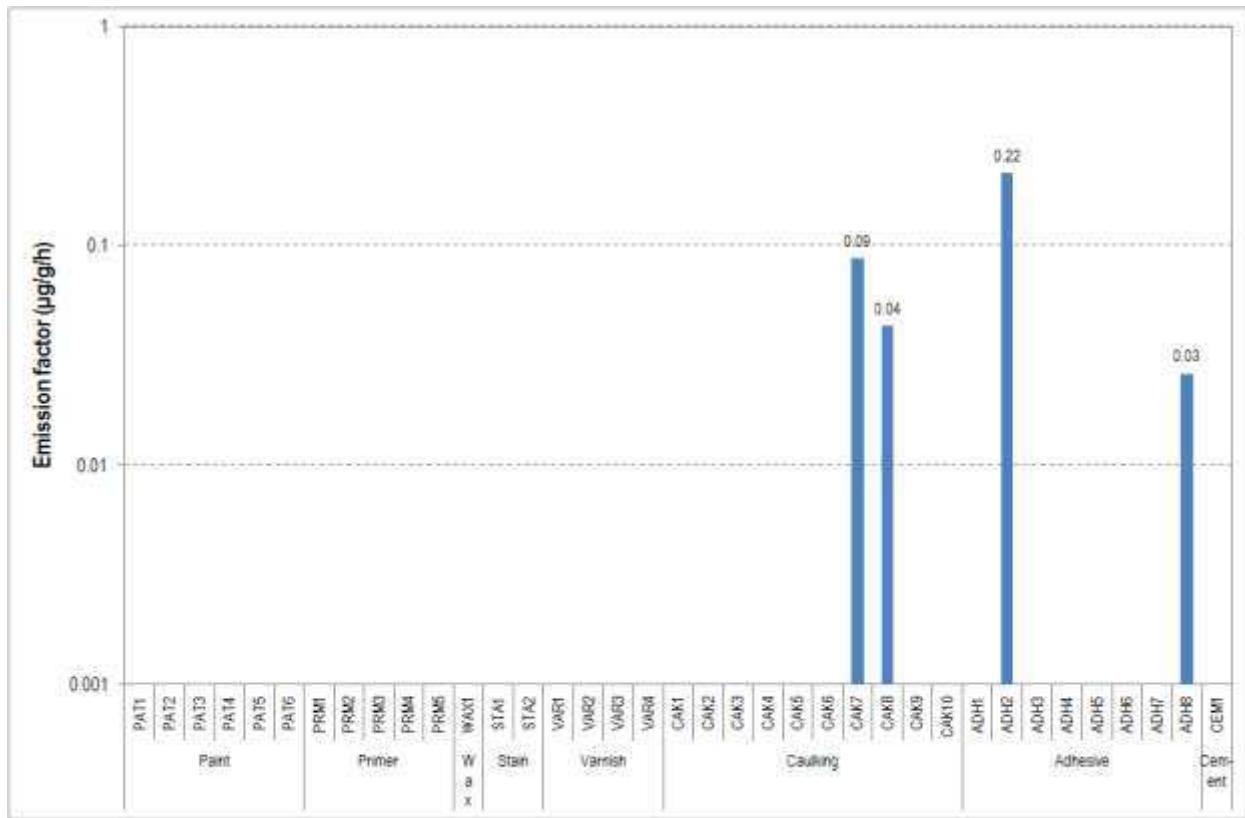


Figure A. 167: Emission factors for liquid building materials (#68: α -pinene)

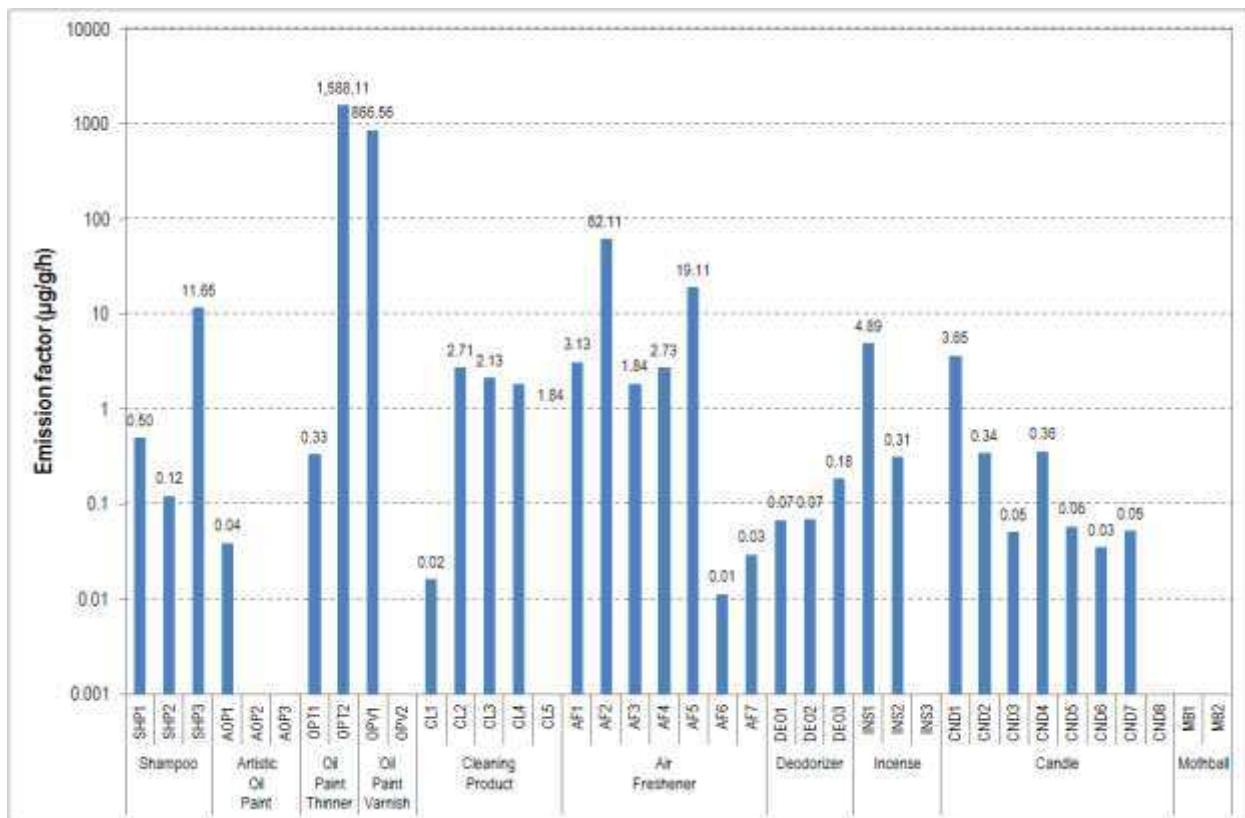


Figure A. 168: Emission factors for consumer/personal-care products (#68: α -pinene)

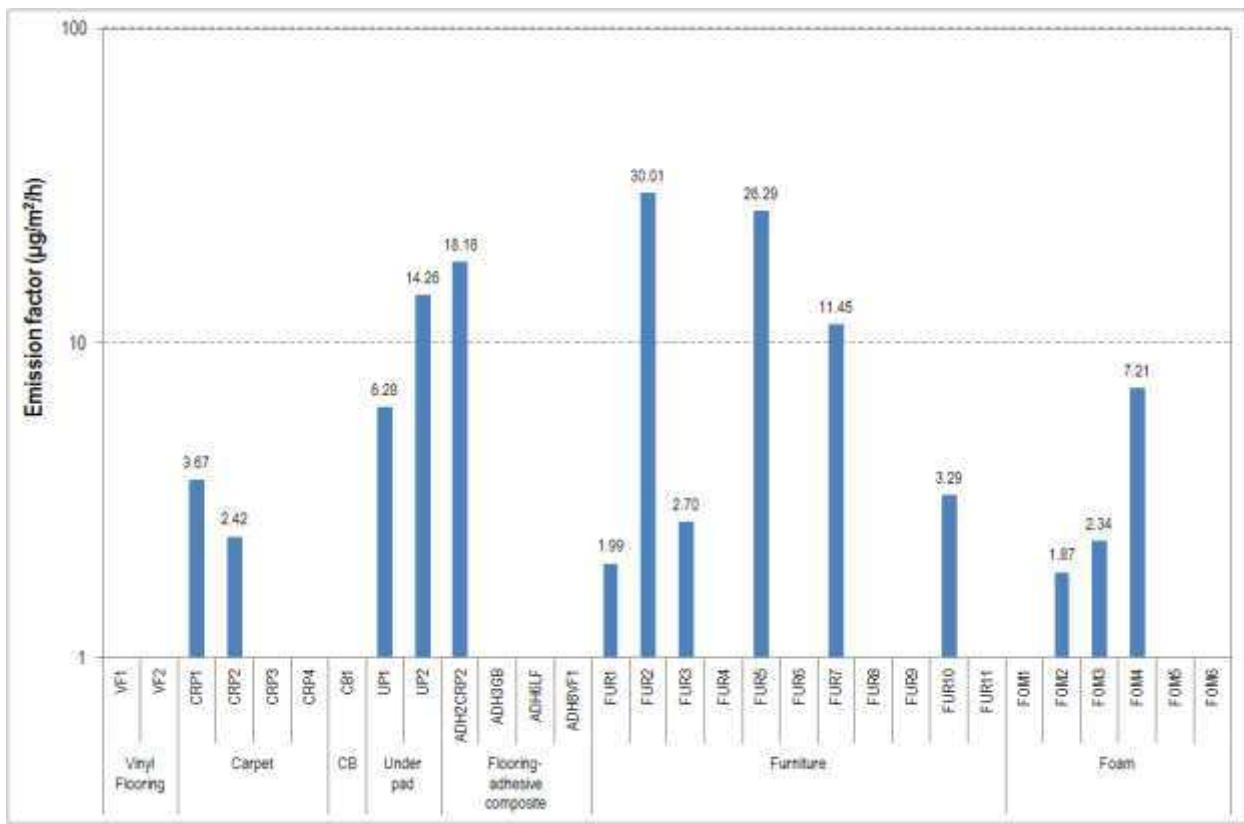


Figure A. 169: Emission factors for solid building materials and furnishings (#69: β -pinene)

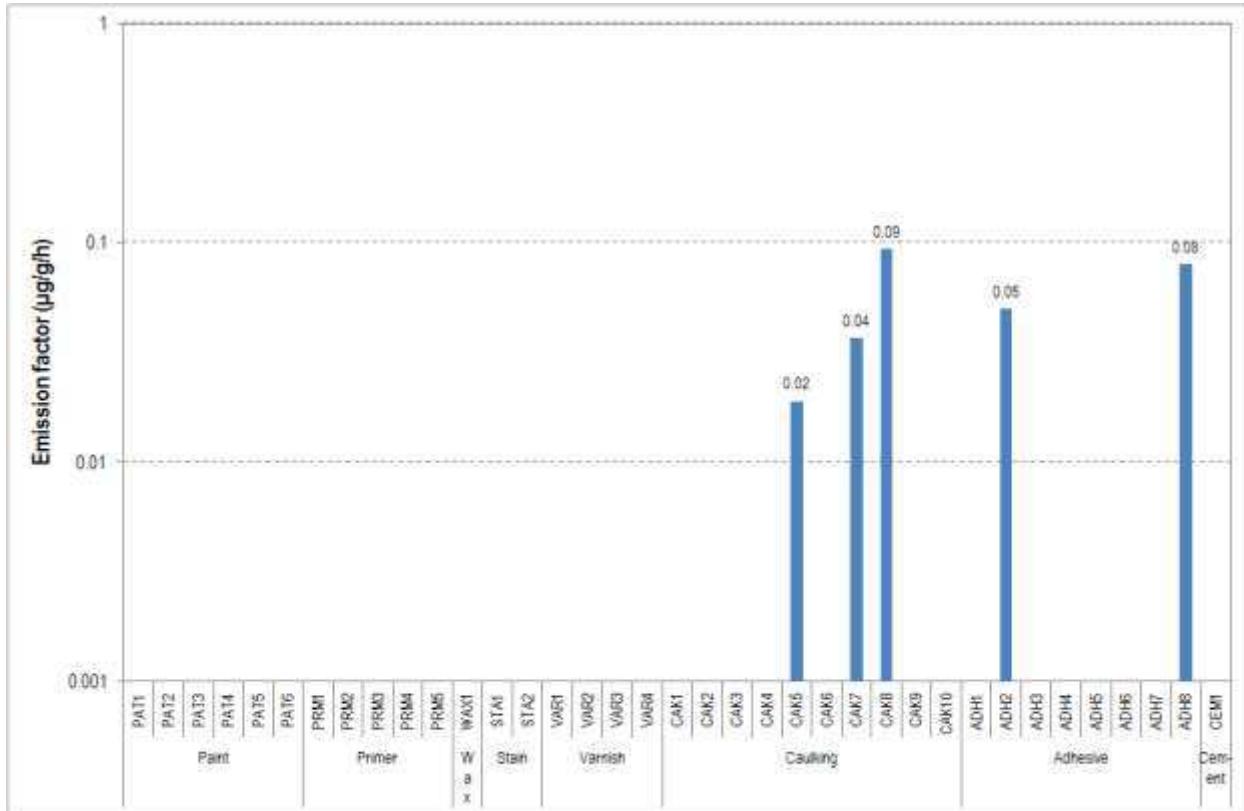


Figure A. 170: Emission factors for liquid building materials (#69: β -pinene)

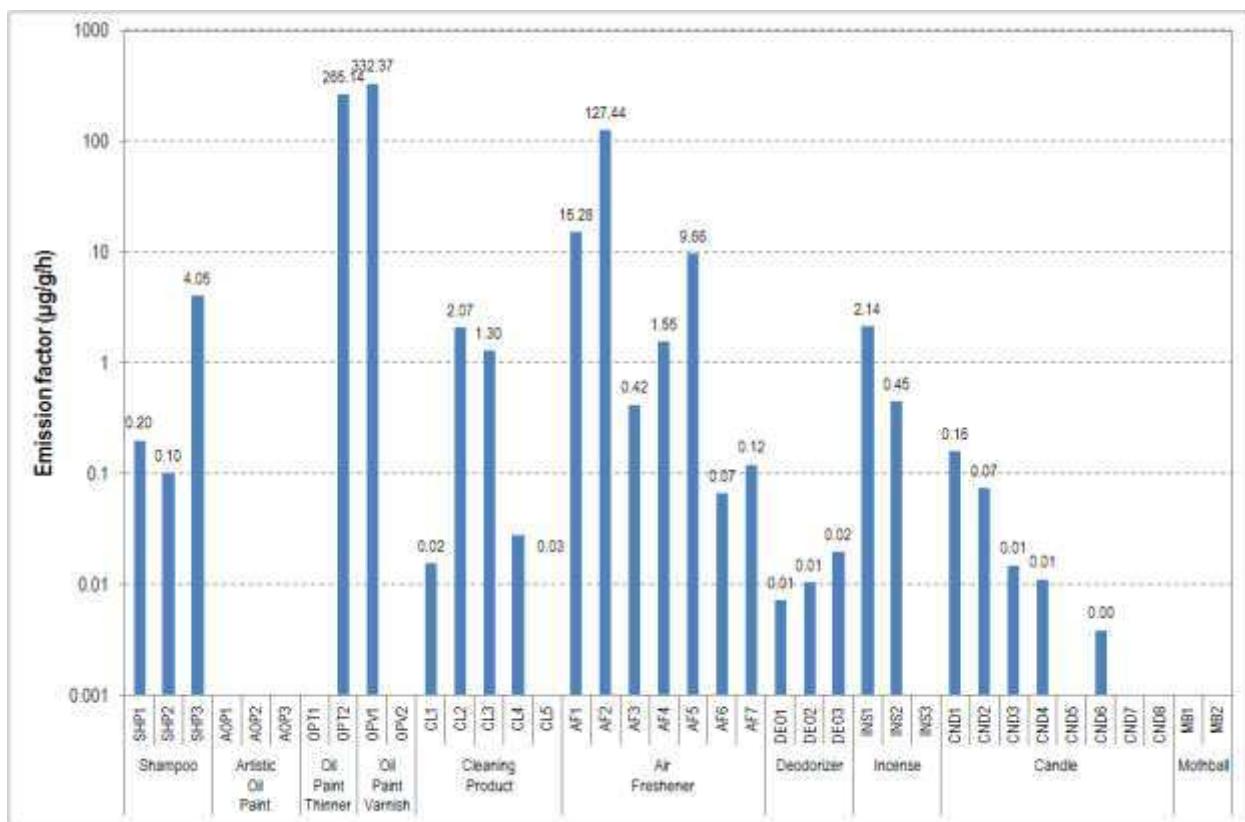


Figure A. 171: Emission factors for consumer/personal-care products (#69: β -pinene)

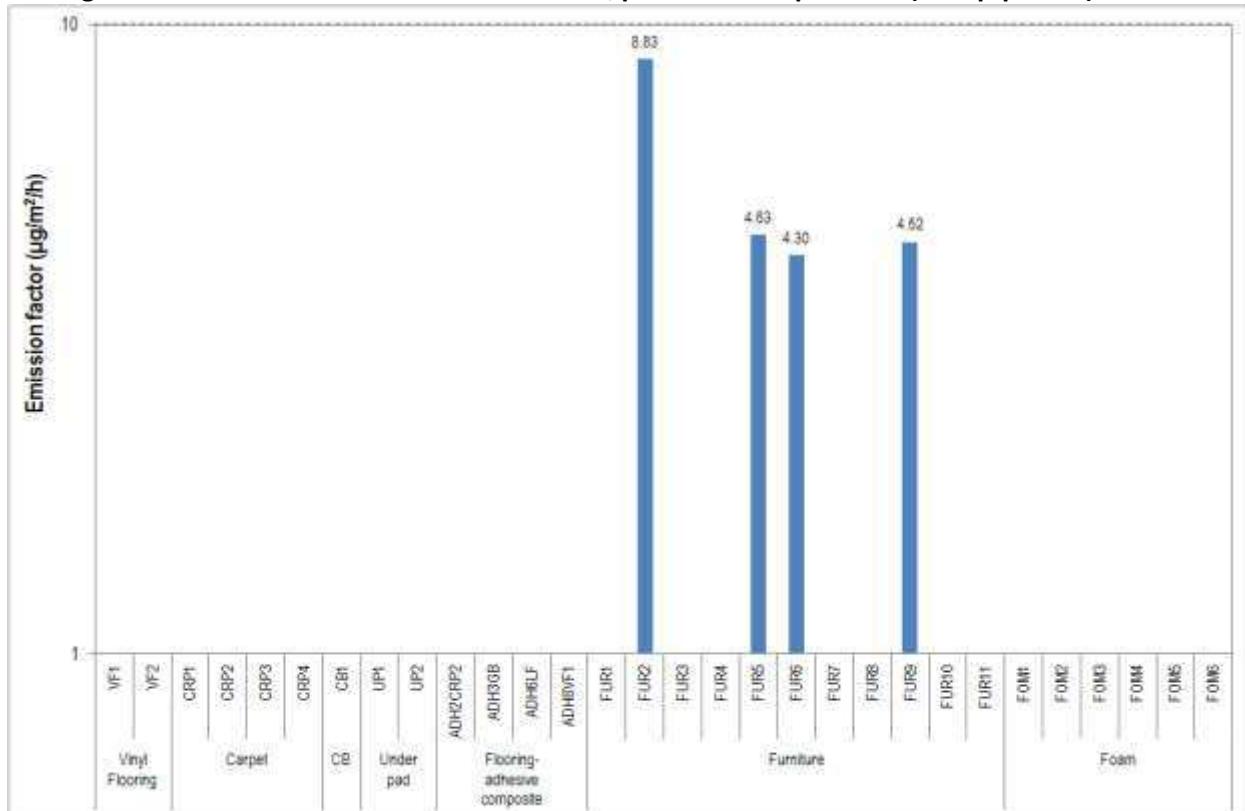


Figure A. 172: Emission factors for solid building materials and furnishings (#70: camphene)

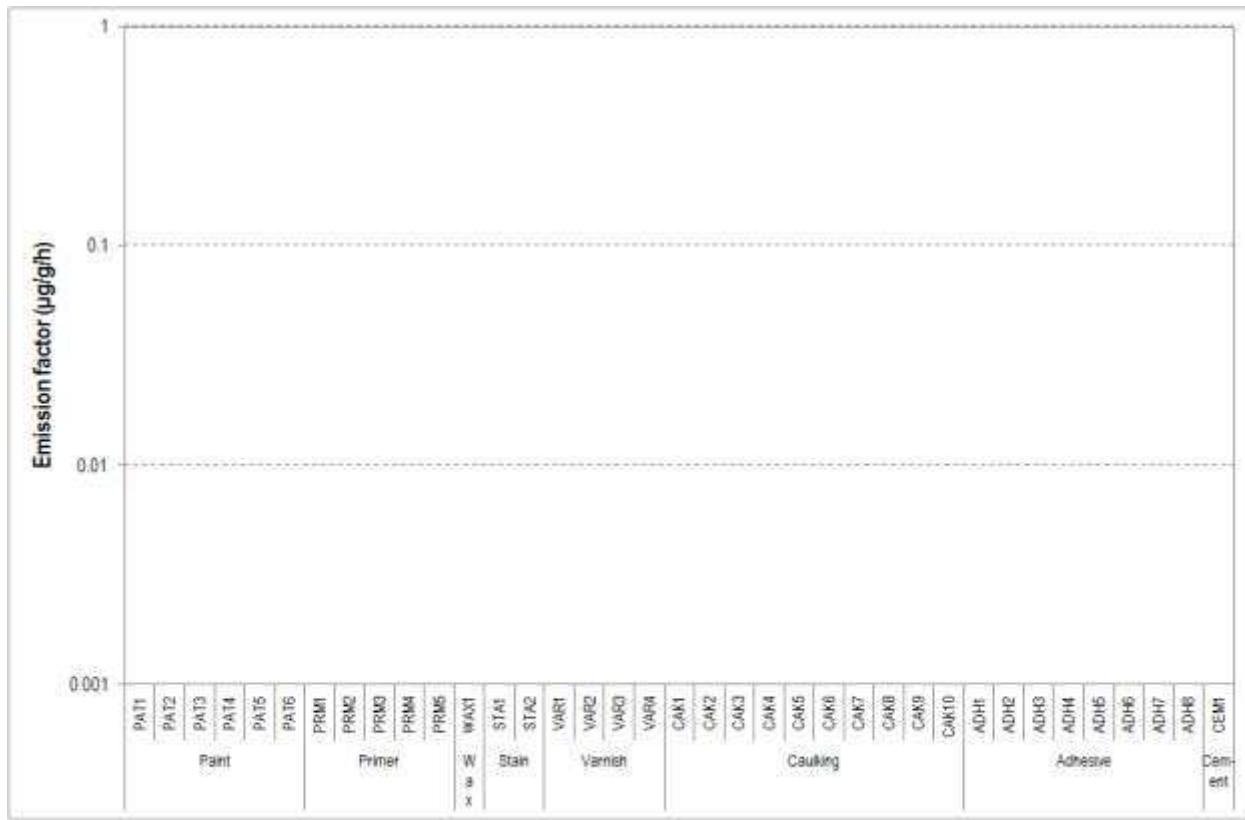


Figure A. 173: Emission factors for liquid building materials (#70: camphene)

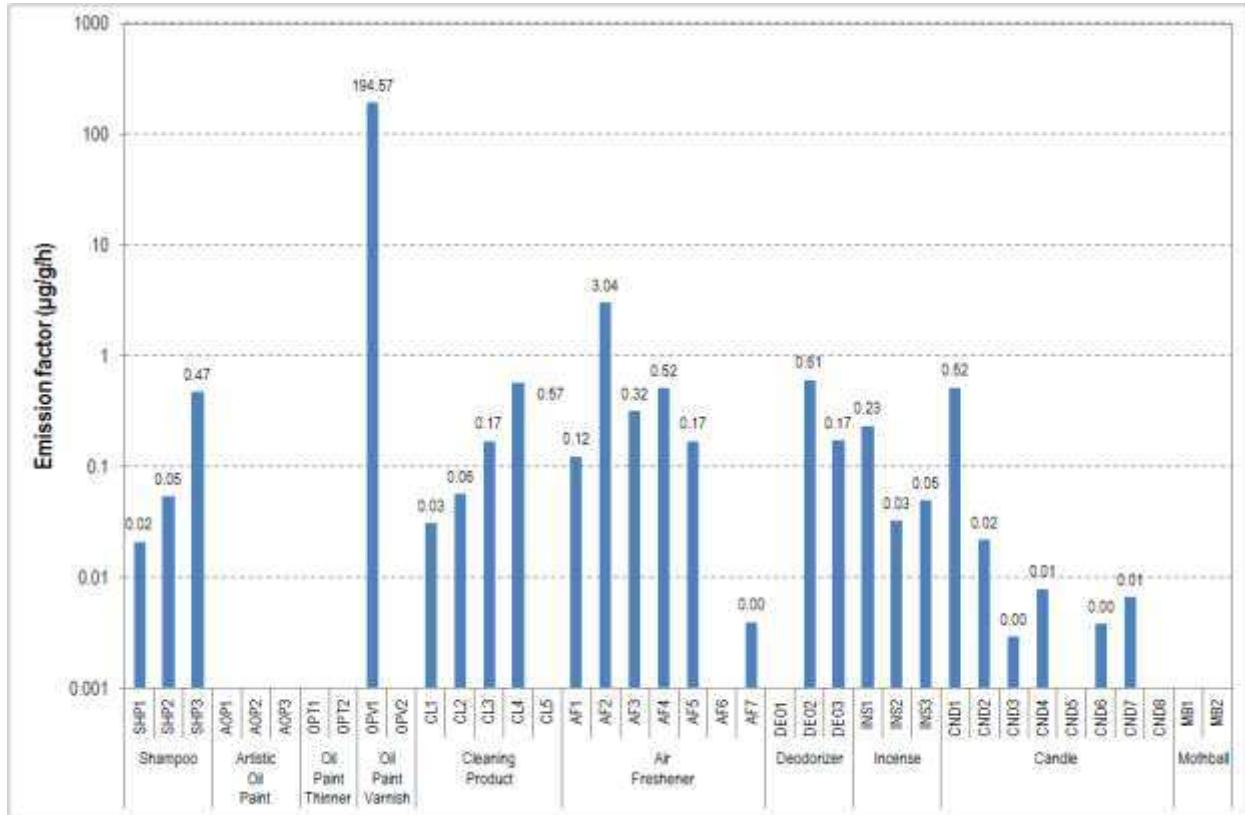


Figure A. 174: Emission factors for consumer/personal-care products (#70: camphene)

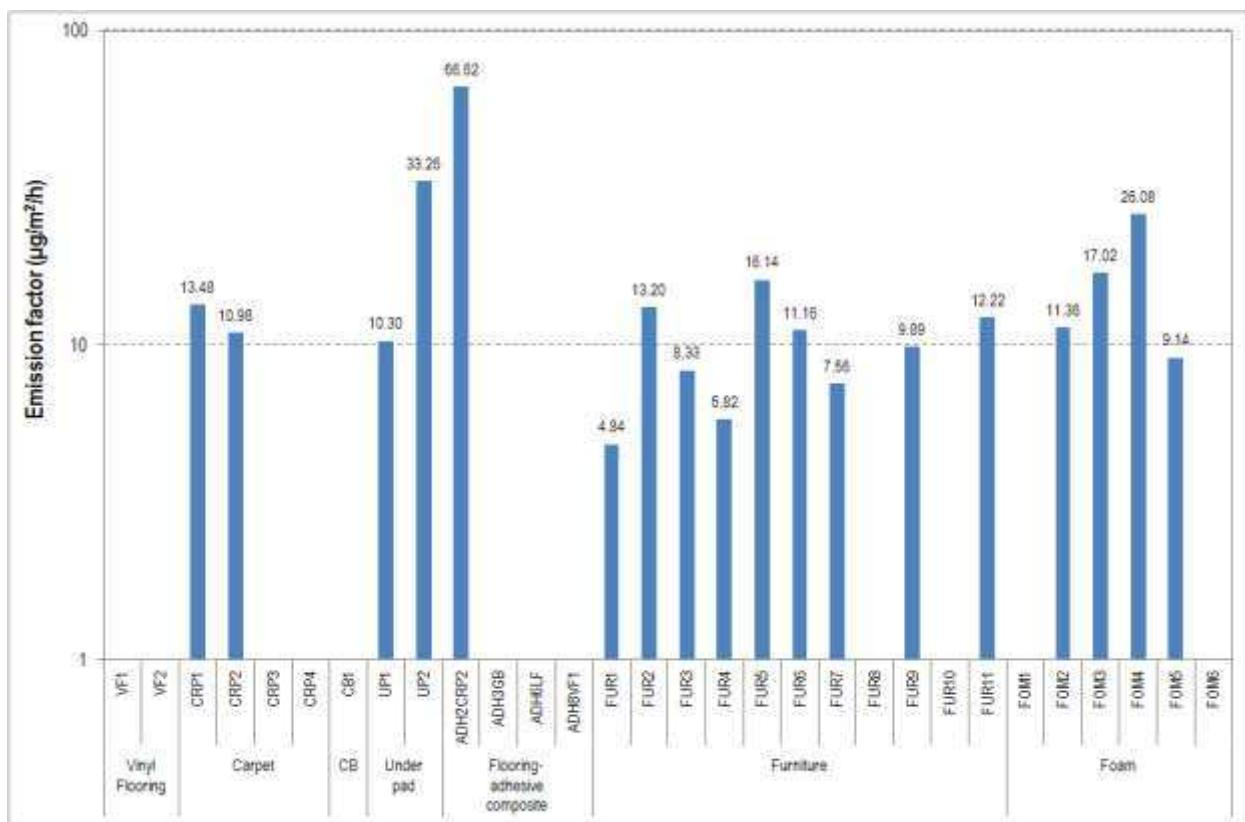


Figure A. 175: Emission factors for solid building materials and furnishings (#71: limonene)

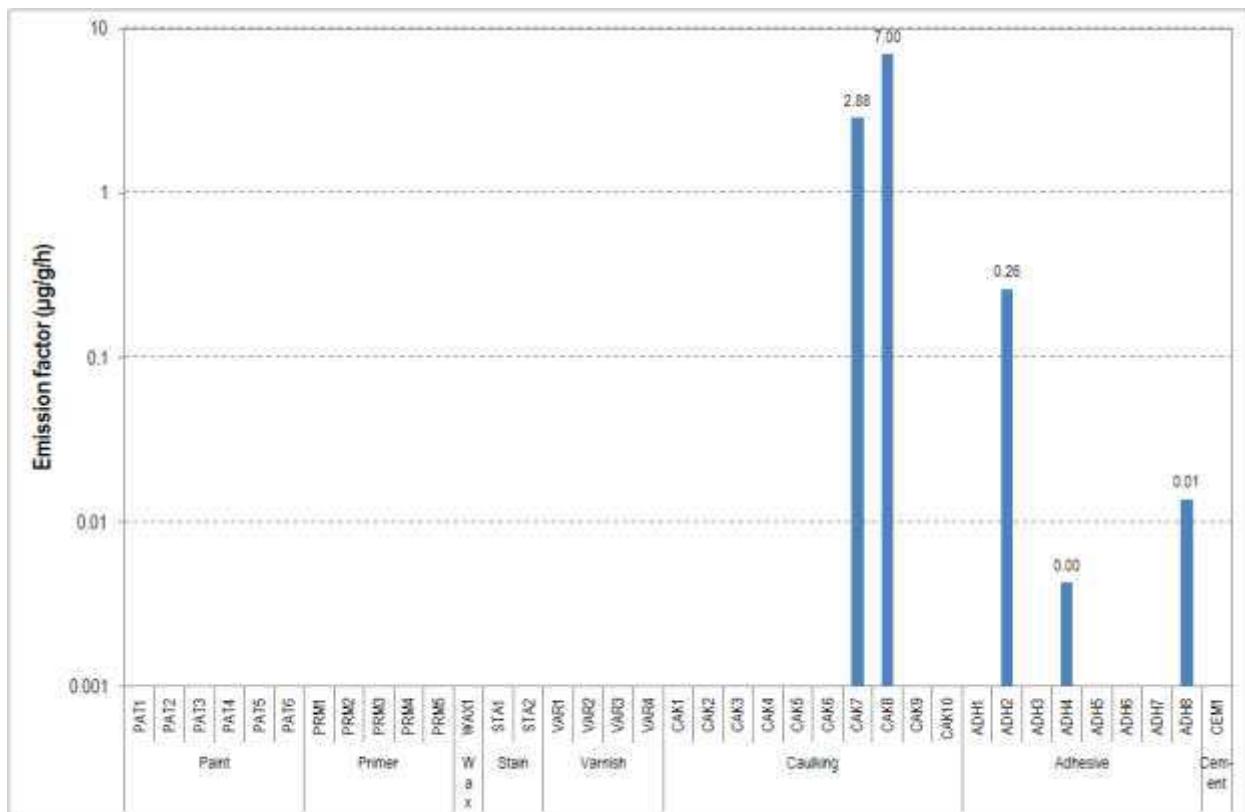


Figure A. 176: Emission factors for liquid building materials (#71: limonene)

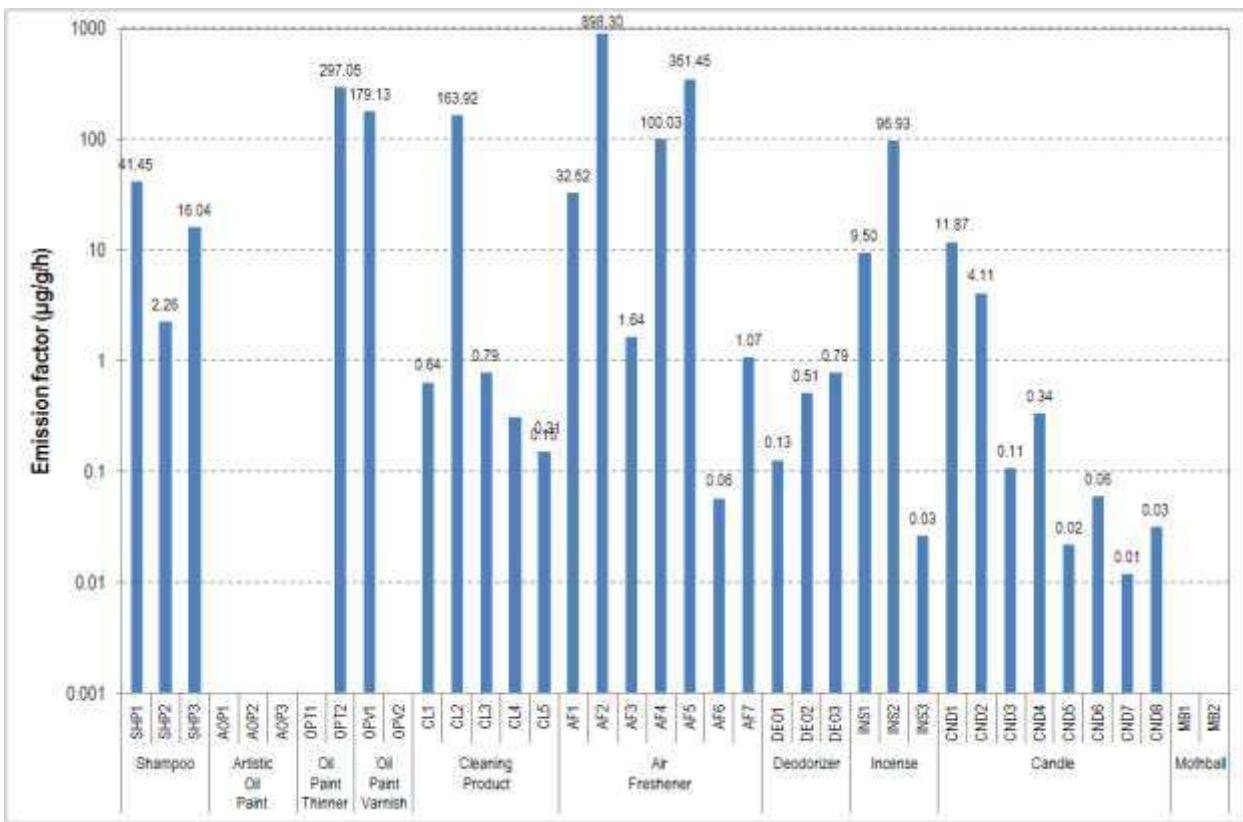


Figure A. 177: Emission factors for consumer/personal-care products (#71: limonene)