

Emission and evaluation of chemical substances from selected electrical and electronic products – part 2

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Summary

The purpose the present study is to carry out measurements for emission of chemical substances from electric and electronical products in use and to assess the potential health risks when the tested products are applied in the household. The study is planned to perform tests of new instruments and instruments that have been used for a shorter period in a simulated use situation.

The following electric and electronical products were selected for testing in co-operation with the Danish Environmental Protection:

- Printer
- Computer (PC)
- Television
- Electrical heater
- Rechargeable batteries
- Household oven
- Hair drier
- Mobile phone with or without charger
- Iron
- Decorative lamp
- Electric panel (multi electric outlet)

All appliances were tested for emission of chemical substances under controlled laboratory conditions. Thermostat-controlled climatic chambers of polished stainless steel were applied for the tests. The measurements included VOCs, aldehydes, isocyanates, and breakdown products hereof, brominated flame retardants and organic tin compounds.

Emission from 73 different substances were determined and the mixture of substances from the tested electrical products. All tested products emit substances in major or minor degree when in use.

The total amount of identified substances is spread over a large number of substance groups (aliphatic hydrocarbons, aromatic hydrocarbons, alcohols, ketones, acrylates, acetates, organic acids, phthalates, siloxanes, and others).

Emission of one or more aldehydes was determined from nearly all tested products. The amounts vary and especially formaldehyde is emitted from a number of products in amounts that are regarded hazardous.

One product emits aliphatic isocyanates (methylisocyanate and isocyanic acid). The emission is transitory and hardly presents a threat of health like consideration.

A product emits brominated flame retardants by way of nona- and decaBDE. The emitted amounts are small. However, please note that both substances are prohibited as of 1st June 2006 in accordance to the EU RoHS directive.

Organic tin compounds were not determined from either of the tested products.

When comparing emissions after 7 hours and after 9 days use there is a significant reduction in substance types as well as amounts of emitted substances from the products after 9 days for 10 of 12 products.

When the emitted substances from the products are compared with the official lists of substances with long-term effect and the Danish Environmental Protection Agency's list of unwanted substances it is ascertained that:

- 15 of 73 substances have documented long-term effects
- 5 of 73 substances are on the list of unwanted substances

Based on the measured source strengths a calculation of the indoor climate concentrations has been performed in a model room and an assessment of health risks at comparison with limit values cf. Environmental project no 32, 2003.

It turns out that the two apparatuses (decorative lamp and household oven) entail such emission of formaldehyde that the theoretical risk factor (f_s) of 1 is significantly exceeded. Formaldehyde is the cause of 8 of the 12 highest calculated risk factors in this project. The remaining 4 cases relate to emission of methylisocyanate, phenol, isocyanic acid, or benzene.

The household oven turned out to emit an unidentified fluorine compound in large amount. It has not been possible to identify the compound within the project's economic frames, thus a health assessment has not been carried out.

1 Description of the project

Electric and electronic products surround us in our every day life. Many of these become overheated – at least some single parts. Especially polymer materials (plastic, rubber, glue, and lacquer etc.) can emit organic fumes at heating. Emission is expected to be highest at the beginning of the product's period of use.

The primary exposure flow for this type of emission is via inhalation. Former tests have indicated that electrical products can emit substances that pose a risk for e.g. allergy, irritation of respiratory organs, hormone-disrupting impact etc.

Electrical and electronic products are so complex and contain many sub-components from hundreds of suppliers that a test of the finished products would be the only safe test method.

In order to provide more knowledge as to the problem's scope the Danish Environmental Protection Agency initiated a project in 2002, where selected products were tested for emission of different chemical substances (Survey no 32, 2003: "Emission and evaluation of chemical substances from selected electrical and electronic products, Survey no. 32 – 2003". Present survey is a continuation of Survey no 32. In order to pass on the experiences from survey no 32 the Danish Environmental Protection Agency has requested that identical test methodologies and assessment criteria are used in the project at hand.

Based on the literature examination survey no 32 conclude that aldehydes and volatile organic compounds (VOCs) basically posed potential problematic emission from electronic products. Thus measurements for these substances were performed in the practical emission test.

The present survey has extended the measurement scope to include isocyanates, amines, aminoisocyanates, brominated flame retardants, and organic tin compounds as literature specifies these substances as potential emission from this type of product, which is supported by the project group's experience.

1.1 Purpose

It is the project's primary goal to extend the available knowledge on different product types' contribution to indoor climate pollution.

The survey will primarily document emission of health hazardous substances from selected electric and electronic products. If possible the emission must be quantified in order to assess the actual health risks. Furthermore, the difference in new and used (over a short period of 9 nine days) products will be tested.

1.2 Project phases

The project is divided into two phases. Phase 1 contains selection of products, selection of relevant substances, and completion of emission test. Phase 2 contains an assessment of possible health impacts.

2 Emission tests

2.1 Selection of product types and products

2.1.1 Criteria for product selection

A number of products have been selected for emission testing in co-operation with the Danish Environmental Protection Agency.

The criteria for product selection have been e.g.:

- Heat generation under normal operation
- Usage pattern
- Danish consumer usage
- Whether the products are used by particularly exposed groups (children, elderly, etc.)
- The potential health risk from the emitted substances

A total of 11 product types have been selected for emission testing. The following section provides a detailed account for the single product type.

Within each product type one or more products have been purchased for emission testing.

The products were purchased in Danish retailing. Purchase has been aimed at products that constitute a dominant or significant part of the sales within the product type in question.

It is stressed that it is about spot tests selected randomly in Danish stores. The results are thus not representative for all apparatuses of the type in question in the Danish market.

2.1.2 Outline of tested products

The following product types are selected for emission testing based in the above-mentioned criteria.

Table 2.1. Outline of tested product types

Product type	Description
Printer	Inkjet colour printer; table model
Household oven	Ceramic cooker with forced convection oven with catalytic purifying glaze
Hair drier	2000 W effect
Mobile phone	Mobile phone with camera
Iron	Steam iron, 2000 W
Decorative lamp	Lamp with halogen light source, rotating colour change and separate disco globe
Computer (PC)	PC with standard monitor and keyboard
Tv-set	28" 16:9 sized television
Electric-panel (multi-plug box)	5-plug box without earth connection
Power heating unit	500 W power heating unit for wall suspension
Rechargeable batteries	3 types of rechargeable batteries including charger, all types NiMH C 1,2 V

The test of the mobile phone has been performed partly with the phone separately partly with the phone and the charger placed in the test chamber.

Prior to the test of the rechargeable batteries three types of batteries with charger were purchased. The batteries' surface temperature during charging was measured in preparatory test. The battery with the highest surface temperature was applied at the continued emission tests.

2.2 Description of performed measurements

2.2.1 Sample scope

The table on the following page demonstrates an outline of the sample scope i.e. measurements contra products. The selection of the sample scope has been performed based on knowledge and experiences on potential emissions form the single products.

Table 2.2: Outline of sample scope

Product type	Aldehydes	VOC's	Isocyanates and amines	Brominated flame retardants	Organic tin compounds
Printers	X	X		X	
Household ovens	X	X	X		
Hair driers	X	X		X	X
Mobile phone	X	X		X	
Mobile phone with charges	X	X		X	
Iron	X	X		X	X
Decorative lamps	X	X	X		X
Computers (PCs)	X	X	X	X	
Tv-sets	X	X	X	X	
Electric panels (multi-plug boxes)	X	X		X	
Power heating unit	X	X	X		
Rechargeable batteries	X	X		X	

2.2.2 Sample preparation

The products are all tested under conditions that represent a normal utility model in any way possible. Products that consist of more parts (e.g. lamp with ancillary motor and transformer) are tested as they are used. Lamp, motor, and transformer are thus tested as one.

The emissions are documented partly shortly after commissioning (7 hours) and after a longer period of use (9 days). Before the first emission test the products have been simulated used for 24 hours. The product in question has been simulated used for 9 days in a relevant utility model between first and second emission test.

The table on the next page shows the simulated application situation that the apparatuses have been exposed to before, during, and in between the emission tests.

Table 2.3: Outline of application of products before and during test

Apparatus type	Before 1 measurement session	During emission measurement	Between 1 and 2 measurement session
Printer	On for 7 hours without printing	On for the entire period. Printed 30 colour copies during the measurement period.	On for 7 hours every day. Each day print 15 colour copies. Between 1. and 2. emission measurement printing was change from black/white to colour.
Household oven	On for 7 hours at 200°C	On the entire measurement period at 200°C	On for 1 hours every day at 200°C
Hair drier	On at maximum effect for 7 periods of 15 minutes.	On and off for periods of 15 minutes. When operational on at maximum effect.	On for 10 minutes every day at maximum effect.
Mobile phone 1 (excl. charger)	Charging for 7 hours. Subsequently discharge.	Charger outside chamber.	On the entire period of 9 days. Charged according to need (twice during the period).
Mobile phone 2 (with charger)	Charging for 7 hours. Subsequently discharge.	Charger in chamber.	On the entire period of 9 days. Charged according to need (twice during the period).
Iron	On with maximum effect for 7 hours	Maximum effect during the measurement period	20-30 minutes on maximum effect every day
Decorative lamp	On for 2 hours	Lamp + motor on the entire period.	Lamp and motor on for 2 hours every day
Computer (PC)	On for 7 hours (computer and monitor)	Computer and monitor on the entire period running software demo-programme.	Computer and monitor on for 2 hours every day
Tv-set	On for 7 hours	On the entire period with screensaver	On every day for 4.5 hours
Electric panels (multi-plug boxes)	Used for hair drier and phone charger for 7 hours	Subjected with approximately 2,500 W during the measurement period	Used for hair drier and phone charger for 5-7 hours every day
Power heating unit	On with maximum effect for 7 hours	On with maximum effect during the entire period. Effect consumption 0.59 kWh during the measurement period.	On for 23 hours per day during the period
Rechargeable batteries	Charged and discharged once	Charging of discharged batteries	Discharge and recharge three times in 9 days.

2.2.3 Description of applied chamber types

The product is placed in a climate controlled test chamber that is purged with a known amount of clean air. The air supply occurs from a central installation equipped with filtration for particles and gasses.

Stainless steel chambers were applied. Present survey used chambers of 0.11 m³, 0.25 m³, and 3.2 m³ respectively depending of the size of the product.

The test chambers are built and operated in accordance with ENV 13419-1. The emission tests are carried out according to identical procedures as are specified at accredited technical testing according to the conditions set forth in Eurofins Danmark's accreditation number 168 (DANAK).

Test conditions during the performed tests were as follows:

Temperature: 23 ± 2° C
Humidity: 50 ± 5% RH
Air change: 0.5 ± 0.05 times pr. hour.

Due to heat emission the tested products influenced the climatic conditions in the chambers in some cases resulting in higher temperatures. The highest temperature rise was observed when testing the household oven (Climate chamber temperature 38°C at the test stop).

2.2.4 Description of applied methods

Measurement for content of contaminations in the outlet air from the chambers was performed by collection of adsorbents or in collection fluids. A calibrated electronic flow meter types Sierra was used for determination of the collected air amounts.

Before each emission test the chambers' background content of relevant substances (blank values) was determined. If relevant the measurement result has been corrected for blind value before calculation of source strength from the instruments.

The single collection and analytical methods are stated below. Appendix I contain a detailed outline of the substances that are included of measurement for aldehydes, organic tin compounds, brominated flame retardants, and isocyanates.

Aldehydes in air

Principle: Aldehydes (C₁-C₆) collected on 2,4-dinitrophenylhydrazine coated silicagel tubes, eluted with acetonitril. Analysis by HPLC/UV.

References: ISO/DIS 16000-3
VDI 3862-3.

Limit of detection: 0.1-0.5 µg

Volatile organic compounds (VOC/SVOC) in air

Principle Volatile organic compounds collected on ATD-combi tubes with Tenax TA/Chromosorb 106. The components are desorbed thermally from the tubes and analysed at gas chromatography with mass specific detector (ATD/GC/MS). A number of components are quantified

relative to toluene (toluene equivalents). These components are marked with a star (*) in the table of results.

References: ISO/CD 16017-1
MHDS 72

Limit of detection: 5 ng

Isocyanates and amines in air

Principle: Isocyanates/amines are collected in impinger bottles containing dibutylamine in toluene. Amines are derived accordingly with ethylchloroformiate. The derivates are analysed by use of high-performance liquid chromatography with mass selective detection (HPLC/MS).

The method identifies and quantifies diisocyanate, monoisocyanate, isocyanic acid, aminoisocyanates, and amines.

References: Analyst, 121 (1996) p. 1101-1106.

Limit of detection: 0.02 µg (butylisocyanate however 0.1 µg total).

Organic tin compounds

Principle The substances are collected on XADII adsorbent by absorbing a known airflow through the adsorbents. The components are extracted from the adsorption material with 10% acetic acid in methanol. The extract is transferred to water phase and derived with sodium tetraethylborate. The derivates are extracted accordingly with pentane and analysed following evaporation at GC-MS. Tripropyltin is used as internal standard.

Limit of detection: 0.02 µg

Brominated flame retardants

Principle: Polybrominated diphenylethers (PBDE), polybrominated biphenyles (PBB), hexabromocyclododecane (HBCD), and tetrabromobisphenol A (TBBPA) are collected on adsorption tubes containing XADII. The samples are soxhlet extracted with toluene, added ¹³C-labelled internal standards, and analysed at gas chromatography with mass selective detection in the laboratory. The samples are also analysed at gas chromatography with mass selective detection in the laboratory.

References: Environment International 29 (2003) 663-664
ISO draft method 22023

Limit of detection: 0.2 – 5 ng

2.3 Results

The results of the performed emission measurements are given on the following pages. A number of the applied methods are screening methods that measure a very large amount of substances. For clarity only the substances that evaporate in amounts larger than 1 µg/unit/hour. This limit of detection corresponds to the limit of detection applied at survey no 32.

The substances' labelling according to the following lists is given in the tables of results:

- The list of hazardous substances, Order no 439 of June 2002
- The Danish Environmental Protection Agency's guidelines to self classification of hazardous substances, (2001)
- List of unwanted substances, (2004)

Appendix I contain a complete list of the substances that the measurements for aldehydes, isocyanates, aminoisocyanates, amines, organic tin compounds, and brominated flame retardants have included.

2.3.1 Printer

Table 2.4: Emissions from printer

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
Acetic acid	64-19-7	34	<2	R10 C;R35
Limonen*	5989-27-5	27	<2	R10 Xi;R38 R43 N;R50/53
Siloxanes*	-	22	<2	
3-Caren	13466-78-9	5.4	<2	
2-Ethylhexylacrylate*	103-11-7	4.0	5.4	Xi;R37/38 R43
Formaldehyde	50-00-0	3.5	7.8	T; R23/24/25 C;R34 Carc3;R40 R43
Hexanal	66-25-1	2.2	<2	
2-Pyrrolidinone	616-45-5	<2	61	Xn;R22
1,2-Hexandiol*	6920-22-5	<2	24	
Unidentified	-	12	12	

*: Quantified as toluene equivalents

Note: Toner change from black to colour between 1. and 2. measurement round

2.4 Household oven

Table 2.5: Emissions from household oven

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
Siloxanes*	-	1100	290	
2-butanon	78-93-3	990	400	F;R11 Xi;R36 R66 R67
Unidentified fluorine compounds*	-	450	7.2	
Formaldehyde	50-00-0	160	210	T; R23/24/25 C;R34 Carc3;R40 R43
Hydrocarbons C10-C18	-	57	4.2	
3-Caren	13466-78-9	42	<5	N;R51/53
Nonanal	124-19-6	30	<5	N; R50
Butyraldehyde	123-72-8	27	27	F; R11
Limonen	138-86-3	26	<5	R10 Xi;R38 R43 N;R50/53
Benzene	71-43-2	18	<5	T;R48/23/24/25
Octanal	124-13-0	18	<5	R10 Xi;R36/38
Ethylhexanol	104-76-7	18	<5	
Benzoic acid*	65-86-0	13	6.7	
Phenol	108-95-2	13	<5	T;R24/25; C;R 34 List of unwanted substances
Nonanic acid*	112-05-0	11	<5	C;R34
alfa-Pinen	80-56-8	10	7.8	N;R50/53
C10-aromates	-	10	<5	
Decanal*	112-31-2	9.8	<5	
Diethylphthalate	84-66-2	8.0	<5	
Styrene	100-42-5	7.8	<5	R10 Xn;R20 Xi;R36/38
2-Ethyl hexanic acid	149-57-5	6.1	<5	Rep3;R63
Benzaldehyde	100-52-7	5.6	4.2	Xn;R22
C9-aromates	-	5.1	<5	
Xylene	106-42-3	5.0	<5	R10 Xn;R20/21 Xi;R38
Methylisocyanate	624-83-9	0.75	<5	Fx ;R12 T;R23/24/25 Xi;R36/37/38
Isocyanic acid	75-13-8	0.67	<5	
Acetaldehyde	75-07-0	<3	120	Fx;R12 Xi;R36/37 Carc3;R40
Pentanal	110-62-3	<3	40	
Propionaldehyde	123-38-6	<3	22	F;R11 Xi;R36/37/38
Unidentified	-	160	<10	

*: Quantified as toluene equivalents

2.4.1 Hårtørrer

Table 2.6: Emissions from hair dryer

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
Hydrocarbons C12- C16*	-	130	120	
Xylene	106-42-3	11	15	R10 Xn;R20/21 Xi;R38
Butylacetate	123-86-4	10	<3	R10 R66 R67
Dibutylphthalate	84-74-2	9.0	<3	Rep2;R61 Rep3;R62 N;R50
Ethylbenzene	100-41-4	7.7	11	F;R11 Xn;R20 suspected carcinogenic
Butanol*	110-82-7	5.6	14	F;R11 Xi; R38 Xn; R65 R67 N; 50/53
Limonen*	5989-27-5	5.3	<3	R10 Xi; R38 R43 N;50/53
Tetrahydrofurane*	109-99-9	4.6	<3	F; R11 R19 Xi;R36/37
Benzothiazol*	95-16-9	4.5	6.7	Xn; R22 R43
Formaldehyde	50-00-0	4.2	5.8	T; R23/24/25 C;R34 Carc3;R40 R43
Ethylglycolacetate*	111-15-9	4.0	6.4	Rep2;R60-61 Xn;R20/21/22
Ethylhexanol	104-76-7	4.0	<3	
Butyraldehyde	123-72-8	3.8	<5	F;R11
3-Caren	13466-78- 9	2.4	<3	N;R51/53
Phenyl-1-butene	824-90-8	<2	2.2	
Styrene	100-42-5	<2	1.8	R10 Xn;R20 Xi;R36/38
C10 aromates	-	<2	1.8	

*: Quantified as toluene equivalents

2.5 Iron

Table 2.7: Emissions from iron

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
Hydrocarbons* C6-C18	-	230	16	
Siloxaners*	-	100	25	
Formaldehyde	50-00-0	29	0.06	T; R23/24/25 C;R34 Carc3;R40 R43
Toluene	108-88-3	25	0.64	F;R11 Xn;R20
Acetaldehyde	75-07-0	18	<1	Fx;R12 Xi;R36/37 Carc3;R40
Trimethylsilanol*	1066-40-6	16	<1	
Butanol*	110-82-7	24	0.91	F;R11 Xi; R38 Xn; R65 R67 N; 50/53
Phenol	108-95-2	12	1.5	T;R24/25; C;R34 List of unwanted substances
Tetrahydrofurane*	109-99-6	9.6	<1	F;R11 R19 Xi;R36/37
Hexanal	66-25-1	5.3	<0.3	
1,1-Phenylen-bis-ethanon*	1009-61-6	5.0	3.8	
Methoxy-phenyl oxime*	1000222-86-6	4.5	1.2	
N-methylpyrrolidon	872-50-4	4.4	<1	Xi; R36/38
C9-aromatee	-	2.5	<1	
Butyrolacton*	96-48-0	2.1	<1	
Benzaldehyde	100-52-7	1.5	<0.3	Xn;R22
Butyraldehyde	123-72-8	1.3	<0.3	F;R11
Acetophenon	98-86-2	0.89	<0.5	Xn;R22 Xi;R36
Unidentified	-	91	6,6	

*: Quantified as toluene equivalents

Emission of nonaBDE and decaBDE (brominated flame retardants) was determined from the product. The source strength is less than 0.05 µg/unit per hour for both substances.

2.5.1 Decorative lamp

Table 2.8: Emissions from decorative lamp

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
Hydrocarbons C9-C17	-	390	120	
Xylene	106-42-3	200	41	R10 Xn;R20/21 Xi;R38
Ethylbenzene	100-41-4	180	28	F;R11 Xn;R20 suspected carcinogenic
Formaldehyde	50-00-0	170	43	T; R23/24/25 C;R34 Carc3;R40 R43
Butanol	110-82-7	260	88	F;R11 Xi; R38 Xn; R65 R67 N; 50/53
Hexanal	66-25-1	79	14	
Toluene	108-88-3	58	8.6	F;R11 Xn;R20
C9-aromates	-	38	<2	
Pentanal	110-62-3	25	7.9	
Butyraldehyde	100-52-7	24	4.6	F ;R11
C10-aromates	-	21	<2	
Acetophenon	98-86-2	12	<2	Xn;R22 Xi;R36
Acetaldehyde	75-07-0	10	2	Fx;R12 Xi;R36/37 Carc3;R40
Methyl formal	109-87-5	6.4	<2	
Propionaldehyde	123-38-6	5.8	1.1	F;R11 Xi;R26/37/38
Butyl formate*	592-84-7	5.0	1.4	F;R11 Xi;R36/37
Styrene	100-42-5	2.6	<2	R10 Xn;R20 Xi;R36/38
2-Ethylfurane	3208-16-0	0.56	<2	Xn ;R22
Ethylhexanol	104-76-7	<2	6.3	
Benzaldehyde	100-52-7	9,4	<2	Xn;R22

*: Quantified as toluene equivalents

2.5.2 Mobile phone 1 (without charger)

Table 2.9: Emissions from mobile phone excl. charger

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
Toluene	108-88-3	29	<1	F;R11 Xn;R20
Siloxanes*	-	1.6	<1	

*: Quantified as toluene equivalents

2.5.3 Mobile phone 2 (incl. charger)

Table 2.10: Emissions from mobile phone incl. charger

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
Toluene	108-88-3	17	<1	F;R11 Xn;R20
Siloxanes*	-	2.1	<1	
Butylated Hydroxytoluene	128-37-0	1.3	<1	Xn,R22 N;R50/53
Xylene	106-42-3	1.1	<1	List of unwanted substances R10 Xn;R20/21 Xi;R38
Hexanal	66-25-1	0.21	<0.4	
Acetaldehyde	75-07-0	0.061	<0.4	Fx;R12 Xi;R36/37 Carc3;R40
Formaldehyde	50-00-0	0.017	<0.2	T; R23/24/25 C;R34 Carc3;R40 R43

*: Quantified as toluene equivalents

2.5.4 Computer (PC)

Table 2.11: Emissions from computer (PC)

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
Hydrocarbons* C8-C15	-	480	260	
Phenol	108-95-2	140	140	T;R24/25; C;R 34 List of unwanted substances
C10-aromates*	-	130	46	
Xylene	106-42-3	91	75	R10 Xn;R20/21 Xi;R38
Butanol	110-82-7	66	88	F;R11 Xi; R38 Xn; R65 R67 N: 50/53
Ethylbenzens*	100-41-4	66	51	F;R11 Xn;R20 suspected carcinogenic
C9-aromates	-	42	22	
Ethylhexanol	104-76-7	37	30	
Formaldehyde	50-00-0	29	32	T; R23/24/25 C;R34 Carc3;R40 R43
Acetophenon	96-86-7	27	18	Xn :R22 Xi ;R36
Ethylhexylacrylate *	103-11-7	27	30	Xi;R37/38 R43
Siloxanes	-	26	40	
Styrene	100-42-5	22	16	R10 Xn;R20 Xi;R36/38
2-Ethylhexanic acid	149-57-5	15	<2	Rep3;R63
Butyldiglycol*	112-34-5	14	2.8	Xi;R36
Tetrahydrofurane *	109-99-9	14	24	F;R11 R19 Xi;R36/37
2-Butoxyethanol	111-76-2	13	<2	Xn; R20/21/22 Xi; R36/38
2,3-Dihydro-4- methyl-1H- Inden*	824-22-6	13	4.5	
Naphtalene	91-20-3	11	5.8	Xn;R22 N;R50/53 List of unwanted substances
alfa-Pinen	108-95-2	11	12	N;R50/53
p-Cresol*	106-44-5	10	8.3	T;R24/25 C;R34
Acetaldehyde	75-07-0	7.5	8.8	Fx;R12 Xi;R36/37 Carc3;R40
Butylated hydroxytoluene	475-20-7	7.4	8.3	Xn,R22 N;R50/53 List of unwanted substances
Longifolen	103-11-7	6.6	2.6	Xi;R37/38 R43
Hexanal	66-25-1	6.2	<2	
1,6- dichlorocyclocta dien*	29480-42- 0	5.9	<2	
Hydroxyethylmet hacrylate*	868-77-9	5.6	3.5	Xi;R36/38 R43
Methylnaphtalen e*	90-12-0	5.1	<2	
Propionaldehyde	123-38-6	5.0	<2	F ;R11 Xi;R36/37/38
Kodaflex	6846-50-0	4.0	<2	R43
2- Methylcyclopenta non*	1120-72-5	2.6	<2	Xn;R22
Decahydronaphta lene*	493-02-7	2.1	<2	
Ethylacetate	141-78-6	<2	12	F;R11 Xi;R36 R66 R67
Butylglycol	111-76-2	<2	6.6	Xn;R20/21/22 Xi;R36/38
Benzaldehyde	100-52-7	<2	4.1	Xn;R22
3-Caren	13466-78-	<2	2.7	N;R51/53

	9		
Unidentified	-	78	<10

*: Quantified as toluene equivalents

2.5.5 TV-set

Table 2.12: Emissions from TV-set

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
Acetic acid	64-19-7	56	38	R10 C;R35
2-(2-ethoxyethoxyethanol)*	111-90-0	51	40	
Phenol	108-95-2	30	<2	T;R24/25; C;R 34 List of unwanted substances
2-Butoxyethanol	111-76-2	24	16	Xn;R20/21/22 Xi;R36/38
Hydrocarbons C9-C16	-	20	9.4	
Styrene	100-42-5	13	7.7	R10 Xn;R20 Xi;R36/38
Formaldehyde	50-00-0	13	<1	T; R23/24/25 C;R34 Carc3;R40 R43
Xylene	106-42-3	10	<2	R10 Xn;R20/21 Xi;R38
Limonen	5989-27-5	10	<2	R10 Xi;R38 R43 N;50/53
Methylmethacrylate	80-62-6	6.9	<2	F;R11 Xi;R37/38 R43 List of unwanted substances
alfa-Pinen	108-95-2	5.8	<2	N;R50/53
Hexanic acid	142-62-1	5.8	6.7	
C9-aromates	-	5.6	<2	
Acetaldehyde	75-07-0	5.4	<2	Fx;R12 Xi;R36/37 Carc3;R40
2-Ethyl-1-hexanol	104-76-7	5.3	<2	
Benzaldehyde	100-52-7	5	<2	Xn;R22
3-Caren	13466-78-9	4.3	<2	N;R51/53
Butyraldehyde	123-72-8	4.0	<2	F;R11
1-Ethenyl-4-ethylbenzene*	3454-07-7	3.7	<2	
Ethylbenzene	100-41-4	3.2	<2	F;R11 Xn;R20 suspected carcinogenic
Texanol*	25265-77-4	3.2	2.6	
Phthalic acid anhydride*	85-44-9	3.0	<2	Xn;R22 Xi;R37/38-41R42/43 List of unwanted substances
Naphtalene	91-20-3	1.9	<2	Xn;R22 N;R50/53 List of unwanted substances
Diethylphthalate	84-66-2	1.9	<2	
2-methyl-1-propylbenzene	768-49-0	1.7	<2	N;R50/53
Unidentified	-	38	23	

*: Quantified as toluene equivalents

2.5.6 Electric panel (multi plug box)

Table 2.13: Emissions from electric panel (multi plug box)

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
2-Ethylhexanol	104-76-7	5	2.3	
Hydrocarbons C11- C14	-	0.5	<1	
alfa-Pinen	108-95	0.42	<1	N;R50/53
Longifolen*	103-11-7	0.26	<1	Xi;R38 R43 N;R50/53
Formaldehyde	50-00-0	0.06	0.50	T; R23/24/25 C;R34 Carc3;R40 R43
Acetaldehyde	75-07-0	0.06	<0.1	Fx;R12 Xi;R36/37 Carc3;R40

*: Quantified as toluene equivalents

2.5.7 Power heating unit

Table 2.14: Emissions from power heating unit

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
Hydrocarbons C6- C11	-	14	<2	
Acetophenon	98-86-2	14	13	Xn;R22 Xi;R36
Propionaldehyde	123-38-6	9.1	<2	F;R11 Xi;R36/37/38
Siloxanes*	-	9.0	<2	
Acetic acid	64-19-7	7.4	<2	R10 C;R35
Hexane	110-54-3	7.2	<2	F;R11 Xi;R38 Xn;R48/20- 65 Rep3R62 R67 N;R51/53 R10 R66 R67
Butylacetate	123-86-4	4.8	<2	
Hexanic acid	142-62-1	4.8	<2	
Heptanic acid*	111-14-8	4.8	<2	C;R34
Nonanic acid	112-05-0	4.3	<2	C;R34
Formaldehyde	50-00-0	3.8	3.2	T; R23/24/25 C;R34 Carc3;R40 R43
Acetaldehyde	75-07-0	3.7	<2	Fx;R12 Xi;R36/37 Carc3;R40
Octanic acid	124-07-2	2.6	<2	

*: Quantified as toluene equivalents

2.5.8 Rechargeable batteries

Table 2.15: Emissions from rechargeable batteries

Substance	CAS no	After 7 hours (µg/unit/hour)	After 9 days (µg/unit/hour)	Labelling
Xylene	106-42-3	170	46	R10 Xn;R20/21 Xi;R38
Ethylbenzene	100-41-4	140	34	F;R11 Xn;R20 mistænkt kræftfr.
C9-aromates	-	83	24	
Toluene	108-88-3	77	9.4	F;R11 Xn;R20
C10-aromates	-	13	1.2	
Hydrocarbons C8- C14	-	8.3	<1	
Styrene	100-42-5	7.2	1.4	R10 Xn;R20 Xi;R36/38
Acetophenon	98-86-2	1.8	<1	Xn;R22 Xi;R36
Benzaldehyds	100-52-7	0.94	<1	Xn;R22
Hexanal	66-25-1	0.83	<0.1	
Limonen*	5989-27-5	0.77	<1	R10 Xi;R38 Rr43 N;R50/53
Propionaldehyde	123-38-6	0.37	2.3	F;R11 Xi;R36/37/38
Formaldehyde	50-00-0	0.22	0.28	T; R23/24/25 C;R34 Carc3;R40 R43
Acetaldehyde	75-07-0	0.16	<0.1	Fx;R12 Xi;R36/37 Carc3;R40
Unidentified	-	4.3	<2	

*: Quantified as toluene equivalents

3 Assessment of potential health impacts

An assessment of potential health risks has been prepared based on the substances that have been determined in the test of the electronic products. The assessment was prepared according to the same guidelines as was applied in survey no 32, 2003 (Emission and evaluation of chemical substances from selected electrical and electronic products). The measured concentrations have been assessed in a model room.

There has been a minor change in the reporting of potential health hazardous impacts in the identified substances compared to survey no 32, as the present report is focused on official lists published by the Danish Environmental Protection Agency. The following lists have been applied:

- List of hazardous substances; Order no 439 of June 2002
- The Danish Environmental Protection Agency's guiding list to self classification of hazardous substances, 2001
- List of unwanted substances, 2004

3.1 Identified substances

Emission of 73 different substances and compounds from the tested electric products in this survey has been determined. All the tested products emit substances in major or minor amount at use.

The total amount of determined substances is spread over a wide amount of compounds (aliphatic hydrocarbons, aromatic hydrocarbons, alcohols, ketones, acrylates, acetates, organic acids, phthalates, siloxanes etc.). The major emission of single component was identified for siloxanes and 2-butanon with 1100 µg/hour and 990 µg/hour respectively

Emission from one or more aldehydes from practically all the tested products was determined. E.g. formaldehyde was emitting in amounts from 0.02 to 210 µg/hour.

One product emits aliphatic isocyanates (methylisocyanate and isocyanic acid). Source strength is 0.75 µg/hour for methylisocyanate as the dominant component.

One product emits brominated flame retardants in the form of nona- and decaBDE. The source strength is less than 0.05 µg/unit per hour for both substances.

Organic tin compounds were not identified from any of the tested products.

When the emitted substances from the products are compared with the Danish Environmental Protection Agency's list of hazardous substances, the guiding list to self-classification of hazardous substances, and the list of

unwanted substances it may be ascertained that:

- 15 of 73 substances have documented long-time effects
- 5 of 73 substances are included on the list of unwanted substances.

The identified emissions are calculated to potential indoor climate concentrations and any potential health effects are assessed in the following sections.

3.2 Calculation of indoor climate concentrations and risk factors

The performed test has not only carried out an identification of the determined compounds. A determination of the source strength was also carried out for the single relevant substances. The source strength is given in tables in section 2.

The measured source strengths are calculated to potential indoor climate concentrations. When calculating it is assumed that the tested electronic products are used in a room with cubic content of 17.4 m³ and an air change of 0.5 times per hour. This corresponds to a typical child's room in a well-insulated single-family house.

The calculated indoor climate concentrations (c_R) are given in the table in appendix 3.

In survey no 32 the risk attached to the calculated indoor climate concentration risk is assessed by calculation of a risk factor (f_s). This factor appears by dividing the calculated indoor climate concentration with the Danish Working Environment Service's limit value (LV) for the substance in question multiplied with a safety factor. The safety factor is set with the aim to consider particular vulnerable groups (e.g. children and expectant mothers), durability of exposure, and potential synergies. Please see survey no 32 for more detailed description. Survey no 32 uses a safety factor of 100. This corresponds to multiplying the limit value with 0.01 when the risk factor is calculated as stated in survey no 32.

The expression for calculation of the risk factor f_s is as follows:

$$f_s = C_R / (GV \times s), \text{ as } s \text{ is set to } 0.01$$

A risk factor of 1 or more represents a situation that may supposedly include a health risk if the electric instrument in question is used under the described conditions (volume and air change).

A number of the determined substances have no defined limit value or a tentative limit value from the Danish Working Environment Service. Suggestions for limit values have been searched for in survey no 32 and for any limit values for the substance in question in other countries (Norway, Sweden, and United Kingdom).

Based in the Danish Working Environment Service's list, survey no 32, and other countries' official limit values it has been possible to outline limit values to this survey for a total of 46 of the determined 73 substances (65%). The used limit values and their source are given in appendix 4.

It is beyond the limits of this project to set limit values for substances without limit values. Instead a separate assessment of substances that occur in the calculated indoor climate concentrations of 0.01 mg/m³ or more has been performed. 0.01 mg/m³ is used as a lower threshold limit as the concentrations below this limit are not assessed to pose a risk for the actual substances.

3.3 Substances with limit value

The calculated risk factors are given in the following tables (table 3.1 – 3.12) for the test instruments. The results are briefly commented for each instrument.

3.3.1 Printer

Table 3.1: Emissions from printer

Substance	GV mg/m ³	After 7 hours fs	After 9 days fs	Labelling
Acetic acid	25	0.02	<0.01	R10 C;R35
Limonen	140	<0.01	<0.01	R10 Xi;R38 R43 N;R50/53
3-Caren	140	<0.01	<0.01	N;R51/53
2-Ethylhexylacrylate	38	<0.01	<0.01	Xi;R37/38 R43
Formaldehyde	0.4	0.10	0.22	T; R23/24/25 C;R34 Carc3;R40 R43
Hexanal	300	<0.01	<0.01	

Risk factor above 1 has not been identified for either of the determined substances. In accordance with the applied assessment criteria the risks seem to be limited when applying this type of printer under the described conditions.

The cause of the difference between the two test rounds is attributed to change of toner from black to colour between round 1 and 2.

3.3.2 Household oven

Table 3.2: Emissions from household oven

Substance	GV mg/m ³	After 7 hours Fs	After 9 days Fs	Labelling
2-butanon	145	0,08	0,03	F;R11 Xi;R36 R66 R67
Formaldehyde	0.4	4.6	6.0	T; R23/24/25 C;R34 Carc3;R40 R43
Hydrocarbons C10- C18	180	<0.01	<0.01	
3-Caren	140	<0.01	<0.01	N;R51/53
Limonen	140	<0.01	<0.01	R10 Xi;R38 R43 N;R50/53
Benzene	1.6	0.13	<0.01	T;R48/23/24/25
Ethylhexanol	500	<0.01	<0.01	
Phenol	4	0.04	<0.01	T;R24/25; C;R 34 Listen over uønskede stoffer
alfa-Pinen	140	<0.01	<0.01	N;R50/53
C10-aromates	137	<0.01	<0.01	
Decanal	300	<0.01	<0.01	

Diethylphthalate	3	0.03	<0.01	
Styrene	105	<0.01	<0.01	R10 Xn;R20 Xi;R36/38
2-Ethyl hexanic acid	100	<0.01	<0.01	Rep3;R63
C9-aromates	50	0.00	<0.01	
Xylene	109	0.00	<0.01	R10 Xn;R20/21 Xi;R38
Methylisocyanate	0.02	0.43	<0.01	Fx ;R12 T;R23/24/25 Xi;R36/37/38
Isocyanic acid	0.02	0.39	<0.01	
Acetaldehyde	45	<0.01	0.03	Fx;R12 Xi;R36/37 Carc3;R40
Pentanal	175	<0.01	<0.01	
Propionaldehyde	100	<0.01	<0.01	F;R11 Xi;R36/37/38

The emission of formaldehyde from the oven results in a risk factor of more than 1 or both test runs. It is thus assessed that there is a potential health problem caused by emission of formaldehyde from a household oven when put into use. As indicated by the measurement the emission seems to continue for some time, as there is actually an increase in the emission after 9 days. The performed test does not provide possibility for assessment of the continued progress after 9 days.

There is also considerable emission of methylisocyanate, isocyanic acid, and benzene without these emissions causing risk factors above 1.

3.3.3 Hair drier

Table 3.3: Emissions from hair drier

Substance	GV mg/m ³	After 7 hours Fs	After 9 days Fs	Labelling
Hydrocarbons C12- C16	180	0.01	0.01	
Xylene	109	<0.01	<0.01	R10 Xn;R20/21 Xi;R38
Butylacetate	710	<0.01	<0.01	R10 R66 R67
Dibutylphthalate	3	0.03	<0.01	Rep2;R61 Rep3;R62 N;R50
Ethylbenzene	217	<0.01	<0.01	F;R11 Xn;R20 mistænkt kræftfr.
Butanol	150	<0.01	<0.01	F;R11 Xi; R38 Xn; R65 R67 N; 50/53
Limonen	140	<0.01	<0.01	R10 Xi;R38 R43 N;R50/53
Tetrahydrofuran	148	<0.01	<0.01	F; R11 R19 Xi;R36/37
Formaldehyde	0.4	0.12	0.17	T; R23/24/25 C;R34 Carc3;R40 R43
Ethylglycolacetate	27	<0.01	<0.01	Rep2;R60-61 Xn;R20/21/22
Ethylhexanol	500	<0.01	<0.01	
3-Caren	140	<0.01	<0.01	N;R51/53
Styrene	105	<0.01	<0.01	R10 Xn;R20 Xi;R36/38
C10 aromates	137	<0.01	<0.01	

There is no identified emission from the hair drier that involves risk factors above 1. Thus the instrument hardly comprises a health risk at use. There is a slight increase in the emission of formaldehyde from 7 hours to 9 days, however, without attaching significant importance.

3.3.4 Iron

Table 3.4: Emissions from iron

Substance	GV mg/m ³	After 7 hours Fs	After 9 days Fs	Labelling
Hydrocarbons C6- C18	180	0.01	<0.01	
Formaldehyde	0.4	0.83	<0.01	T; R23/24/25 C;R34 Carc3;R40 R43
Toluene	94	<0.01	<0.01	F;R11 Xn;R20
Acetaldehyde	45	<0.01	<0.01	Fx;R12 Xi;R36/37 Carc3;R40
Butanol	150	<0.01	<0.01	F;R11 Xi; R38 Xn; R65 R67 N; 50/53
Phenol	4	0.03	<0.01	T;R24/25; C;R 34 List of unwanted substances
Tetrahydrofuran	148	<0.01	<0.01	F; R11 R19 Xi;R36/37
Hexanal	300	<0.01	<0.01	
N-methylpyrrolidon	20	<0.01	<0.01	Xi; R36/38
C9-aromates	50	<0.01	<0.01	
Butyrolacton	176	<0.01	<0.01	
Acetophenon	49	<0.01	<0.01	Xn;R22 Xi;R36

Immediately after utilization emission of formaldehyde was detected, however, without exceeding the risk factor of 1. The total emission from iron is very limited after 9 days.

Emission of nonaBDE and decaBDE (brominated flame retardants) was detected from the product. The source strength is less than 0.05 µg/unit per hour for both substances and hardly comprise any health problem. However, it should be noted that sale of irons with content of polybrominated diphenylethers per 01.06.2006 will be forbidden according to EU's RoHS-directive.

3.3.5 Decorative lamp

Table 3.5: Emissions from decorative lamp

Substance	GV mg/m ³	After 7 hours Fs	After 9 days Fs	Labelling
Xylene	109	0.02	<0.01	R10 Xn;R20/21 Xi;R38
Ethylbenzene	217	0.01	<0.01	F;R11 Xn;R20 suspected carcinogenic.
Formaldehyde	0.4	4.89	1.2	T; R23/24/25 C;R34 Carc3;R40 R43
Butanol	150	0.02	0.01	F;R11 Xi; R38 Xn; R65 R67 N; 50/53
Hexanal	300	<0.01	<0.01	
Toluene	94	0.01	<0.01	F;R11 Xn;R20
C9-aromates	50	0.01	<0.01	
Pentanal	175	<0.01	<0.01	
C10-aromates	137	<0.01	<0.01	
Acetophenon	49	<0.01	<0.01	Xn;R22 Xi;R36
Acetaldehyde	45	<0.01	<0.01	Fx;R12 Xi;R36/37 Carc3;R40
Propionaldehyde	100	<0.01	<0.01	F;R11 Xi;R36/37/38
Styrene	105	<0.01	<0.01	R10 Xn;R20 Xi;R36/38

Ethylhexanol	500	<0.01	<0.01
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The lamp shows considerable emission of formaldehyde as based on the applied assessment criteria must be considered health hazardous.

The emission is reduced during 8 days with approximately 75%, however, this do not bring the risk factor below 1. A period of one to more weeks after installation of this lamp negative health effects must be expected.

3.3.6 Mobile phone 1 (without charger)

Table 3.6: Emissions from mobile phone excl. charger

Substance	GV mg/m ³	After 7 hours Fs	After 9 days Fs	Labelling
Toluene	94	<0.01	<0.01	F;R11 Xn;R20

3.3.7 Mobile phone 2 (with charger)

Table 3.7: Emissions from mobile phone incl. charger

Substance	GV mg/m ³	After 7 hours Fs	After 9 days Fs	Labelling
Toluene	94	<0.01	<0.01	F;R11 Xn;R20
Butylated Hydroxytoluene	10	<0.01	<0.01	Xn,R22 N;R50/53 List of unwatered substances
Xylene	109	<0.01	<0.01	R10 Xn;R20/21 Xi;R38
Hexanal	300	<0.01	<0.01	
Acetaldehyde	45	<0.01	<0.01	Fx;R12 Xi;R36/37 Carc3;R40
Formaldehyde	0.4	<0.01	<0.01	T; R23/24/25 C;R34 Carc3;R40 R43

Neither with nor without charger a mobile phone of the tested types seems to pose any risk of negative health impacts when used in the indoor climate.

3.3.8 Computer (PC)

Table 3.8: Emissions from computer (PC)

Substance	GV mg/m ³	After 7 hours Fs	After 9 days Fs	Labelling
Hydrocarbons C8-C15	180	0.03	0.02	
Phenol	4	0.40	0.40	T;R24/25; C;R 34 List of unwatered substances
C10-aromates	137	0.01	<0.01	
Xylene	109	0.01	0.01	R10 Xn;R20/21 Xi;R38
Butanol	150	0.01	0.01	F;R11 Xi; R38 Xn; R65 R67 N; 50/53
Ethylbenzene	217	<0.01	<0.01	F;R11 Xn;R20 suspected carcinogenic
C9-aromates	50	0.01	0.01	
Ethylhexanol	500	<0.01	<0.01	
Formaldehyde	0.4	0.83	0.92	T; R23/24/25 C;R34 Carc3;R40 R43
Acetophenon	49	0.01	<0.01	Xn;R22 Xi;R36
Ethylhexylacrylate	38	0.01	0.01	Xi;R37/38 R43
Styrene	105	<0.01	<0.01	R10 Xn;R20 Xi;R36/38
Butyldiglycol	100	<0.01	<0.01	Xi;R36
Tetrahydrofuran	148	<0.01	<0.01	F; R11 R19 Xi;R36/37
2-Butoxyethanol	98	<0.01	<0.01	Xn; R20/21/22 Xi; R36/38
Naphtalene	50	<0.01	<0.01	Xn;R22 N;R50/53 List of unwatered substances
alfa-Pinen	140	<0.01	<0.01	N;R50/53
p-Cresol	175	<0.01	<0.01	T;R24/25 C;R34
Acetaldehyde	45	<0.01	<0.01	Fx;R12 Xi;R36/37 Carc3;R40
Butylated hydroxytoluene	10	0.01	0.01	Xn,R22 N;R50/53 List of unwatered substances
Longifolen	140	<0.01	<0.01	Xi;R37/38 R43
Hexanal	300	<0.01	<0.01	
Hydroxyethylmethacrylate	147	<0.01	<0.01	Xi;R36/38 R43
Propionaldehyde	100	<0.01	<0.01	F;R11 Xi;R36/37/38
Decahydronaphtalene	134	<0.01	<0.01	
Ethylacetate	540	<0.01	<0.01	F;R11 Xi;R36 R66 R67
Butylglycol	98	<0.01	<0.01	Xn;R20/21/22 Xi;R36/38
3-Caren	140	<0.01	<0.01	N;R51/53

The test of the PC indicates emission of a wide range of different compounds of which most are of limited concentrations.

Formaldehyde and phenol seem to pose the most health significant emissions. After 7 hours as well as after 9 days the emission is close to exceeding the risk factor of 1. Although this factor is not exceeded it cannot be dismissed that there may be a health problem for some particularly sensitive persons.

If more PCs are places together in e.g. one computer room this will obviously enhanced the total emission and thus the potential negative health effects.

3.3.9 TV

Table 3.9: Emissions from TV

Substance	GV mg/m ³	After 7 hours Fs	After 9 days Fs	Labelling
Phenol	4	0,09	<0,01	T;R24/25; C;R 34 List of unwanted substances
2-Butoxyethanol	98	<0,01	<0,01	Xn; R20/21/22 Xi; R36/38
Hydrocarbons C9- C16	180	<0,01	<0,01	
Styrene	105	<0.01	<0.01	R10 Xn;R20 Xi;R36/38
Formaldehyde	0.4	0.37	<0.01	T; R23/24/25 C;R34 Carc3;R40 R43
Xylene	109	<0.01	<0.01	R10 Xn;R20/21 Xi;R38
Limonen	140	<0.01	<0.01	R10 Xi;R38 R43 N;R50/53
Methylmethacrylate	102	<0.01	<0.01	F;R11 Xi;R37/38 R43 List of unwanted substances
alfa-Pinen	140	<0.01	<0.01	N;R50/53
C9-aromates	50	<0.01	<0.01	
Acetaldehyde	45	<0.01	<0.01	Fx;R12 Xi;R36/37 Carc3;R40
2-Ethyl-1-hexanol	500	<0.01	<0.01	
3-Caren	140	<0.01	<0.01	N;R51/53
Ethylbenzene	217	<0.01	<0.01	F;R11 Xn;R20 suspected carcinogenic.
Phthalic acid anhydride	1	<0.01	<0.01	Xn;R22 Xi;R37/38-41R42/43 List of unwanted substances
Naphtalene	50	<0.01	<0.01	Xn;R22 N;R50/53 List of unwanted substances
Diethylphthalate	3	<0.01	<0.01	
2-methyl-1-propyl benzene	135	<0.01	<0.01	N;R50/53

The TV shows emission of a wide range of compounds as appears from the table above. For most compounds the emission is expressed with low risk factor.

The largest risk factor is due to formaldehyde after 7 days where the emission corresponds to a risk factor of 0.37.

Thus there seems not to be significant risk of negative health effects caused by emission of chemical compounds from the TV.

3.3.10 Electric panel (multi plug box)

Table 3.10: Emissions from electric panel (multi plug box)

Substance	GV mg/m ³	After 7 hours Fs	After 9 days Fs	Labelling
2-Ethylhexanol	89	<0.01	0.01	
Hydrocarbons C11- C14	180	<0.01	<0.01	
alfa-Pinen	140	<0.01	<0.01	N;R50/53
Longifolen	140	<0.01	<0.01	Xi;R37/38 R43
Formaldehyd	0.4	<0.01	0.10	T; R23/24/25 C;R34 Carc3;R40 R43
Acetaldehyde	45	<0.01	<0.01	Fx;R12 Xi;R36/37 Carc3;R40

The emission of chemical compounds from the multi plug boxes is generally very limited in number of substances as well as amounts.

For certain there is no risk of health effects when using the multi plug boxes of the tested type.

3.3.11 Power heating unit

Table 3.11: Emission from power heating unit

Substance	GV mg/m ³	After 7 hours Fs	After 9 days Fs	Labelling
Hydrocarbons C6- C11	180	<0.01	<0.01	
Acetophenon	49	<0.01	0.01	Xn;R22 Xi;R36
Propionaldehyde	100	<0.01	<0.01	F;R11 Xi;R36/37/38
Acetic acid	25	<0.01	<0.01	R10 C;R35
Hexane	700	<0.01	<0.01	F;R11 Xi;R38 Xn;R48/20-65 Rep3R62 R67 N;R51/53
Butylacetate	710	<0.01	<0.01	R10 R66 R67
Formaldehyde	0,4	0.11	0.01	T; R23/24/25 C;R34 Carc3;R40 R43
Acetaldehyde	45	<0.01	<0.01	Fx;R12 Xi;R36/37 Carc3;R40

As is the case with a number of the other instruments the power heating unit also shows emission of a number of compounds in relatively low concentrations with formaldehyde with the highest emission measured compared to the substances' limit value.

The power heating unit is not give cause to any negative health impacts resulting from chemical compounds.

3.3.12 Rechargeable batteries

Table 3.12: Emissions from rechargeable batteries

Substance	GV mg/m ³	After 7 hours Fs	After 9 days Fs	Labelling
Xylene	109	0.02	<0.01	R10 Xn;R20/21 Xi;R38
Ethylbenzene	217	0.01	<0.01	F;R11 Xn;R20 suspected carcinogenic.
C9-aromates	50	0.02	<0.01	
Toluene	94	0.01	<0.01	F;R11 Xn;R20
C10-aromates	137	<0.01	<0.01	
Hydrocarbons C8-C14	180	<0.01	<0.01	
Styrene	105	<0.01	<0.01	R10 Xn;R20 Xi;R36/38
Acetophenon	49	<0.01	<0.01	Xn;R22 Xi;R36
Hexanal	300	<0.01	<0.01	
Limonen	140	<0.01	<0.01	R10 Xi;R38 R43 N;R50/53
Propionaldehyde	100	<0.01	0.07	F;R11 Xi;R36/37/38
Formaldehyde	0.4	0.01	0.01	T; R23/24/25 C;R34 Carc3;R40 R43
Acetaldehyde	45	<0.01	<0.01	Fx;R12 Xi;R36/37 Carc3;R40

The batteries indicate emission from a number of compounds of which some must likely originate from the applied lacquers.

The emitted amounts are generally low and the batteries including charges will not cause any health hazardous problematic concentrations of chemical substances in the indoor climate if used under conditions similar to those in this report.

3.4 Substances without limit value

The iron and the household oven emit substances in concentrations above the selected lower threshold limit of 0.01 mg/m³ and without limit valued.

The detected substances and related indoor climate concentrations are given in table 3.13.

Table 3.13. Substances without limit value in concentrations above 0.01 mg/m³.

Instrument	Substance	Calculated indoor climate concentration C _R
Iron	Siloxan-compound	0.012
Household oven	Siloxan-compound	0.13
Household oven	Unidentified fluorine compound	0.052

The analysis of the siloxan compound from both household oven and iron shows that it is a mixture with a number of components that is dominated of hexamethylcyclotrisiloxan (CAS no 541-05-9), octamethylcyclotetrasiloxan (CAS no 556-67-2), and decamethylcyclopentasiloxan (CAS no 541-02-6).

These are substances with low acute toxicity. There is only scanty information available of the substances in question. There is, however, reason to believe that the calculated indoor climate concentrations hardly pose a health risk.

Still it should be noted that octamethylcyclotetrasiloxan is included in the Danish Environmental Protection Agency's list of unwanted substances (2004) and is classified as Rep3;R62 R53.

The household oven demonstrated emission of a fluorine-containing compound. This is probable due to emission from the coating on the oven's inside. It has not been possible to identify the compound within the frames of this project and a health assessment can thus not be carried out.

3.5 The emission's process in terms of time

The tables in appendix 3 show the emission of substances after 7 hours and after 9 days' use of the electric products.

There is practically everywhere notable decrease in emission of substances over a short period of use of 9 days. However, the household oven and the decorative lamp still display risk factors larger than 1 for formaldehyde after 9 days' use.

3.6 Final comments

The measurements have shown that a number of substances with well-documented long-time effects can be found among the substances that emit from the electronical products.

This corresponds to survey no 32 where partly the literature study partly the completed test of a limited amount of products indicated a number of the same substances that have been determined in this survey.

When the emitted amount are recalculated to potential indoor climate concentrations and the substances' toxicity is included by way of limit values for the substances in question, there seem to be a risk of health hazardous impacts especially from the tested decorative lamp and the household oven. In both cases the reason is emission of formaldehyde.

Based on the model that has been applied in a similar survey of electric products (Survey no 32, 2003), none of the other products seem to emit substances that comprise a health risk.

A single product emits brominated flame retardants typed polybrominated diphenylethers. The emitted amounts are small and do not comprise an acute health risk. It should be noted that the identified substances as per 01.06.2006 will be prohibited according to EU's RoHS-directive.

Appendix 1

List of compounds included in methods for measurement of aldehydes, organic tin compounds, brominated flame retardants and isocyanates/amino isocyanates

Substance group	Substance included by the method
Aldehydes	Formaldehyde Acetaldehyde Propionaldehyde Butyraldehyde Pentanal Hexanal
Organic tin compounds	Monobutyltin Dibutyltin Tributyltin Triphenyltin Monoctyltin Tetrabutyltin Diocyltin Tricyclohexyltin
Brominated flame retardants	Tribromodiphenylether (TriBDE) Tetrabromodiphenylether (TetraBDE) Pentabromodiphenylether (PentaBDE) Hexabromodiphenylether (HexaBDE) Heptabromodiphenylether (HeptaBDE) Octabromodiphenylether (OctaBDE) Nonabromodiphenylether (NonaBDE) Decabromodiphenylether (DecaBDE) Hexabromocyclododecan (HBCD) Tetrabromobisphenol A (TBBPA) Tetrabromophenyl (TetraBB) Pentabromophenyl (PentaBB) Hexabromophenyl (HexaBB) Heptabromophenyl (HeptaBB) Octabromophenyl (OctaBB) Nonabromophenyl (NonaBB) Decabromophenyl (DecaBB)
Isocyanates/amino isocyanates/amines	Isocyanic acid Methylisocyanate Ethylisocyanate Propylisocyanate Butylisocyanate Phenylisocyanate Hexamethylendiisocyanate 2,6-toluendiisocyanate 2,4-toluendiisocyanate Diphenylmethane-diisocyanat 2,6-toluendiamin 2,4-toluendiamin Diphenylmethan-diamin Toluenaminoisocyanate Diphenylmethan-aminoisocyanate Toluendiisocyanat diurea 3-ring diphenylmethan-diisocyanate

Appendix 2

Substance list with classification according to the Danish Environmental Protection Agency's guidelines, including any unwanted substances

Substance	CAS nr.	C	T	M	S
1,1-Phenylen-bis-ethanon	1009-61-6				
1,2-Hexandiol	6920-22-5				
1,6-dichlorocyclooctadien	29480-42-0				
1-Ethenyl-4-ethyl benzene	03454-07-7				
2-(2-ethoxyethoxyethanol)	111-90-0				
2,3-Dihydro-4-methyl-1H-Inden	824-22-6				
2-butanon	78-93-3				F;R11 Xi;R36 R66 R67
2-Butoxyethanol	111-76-2				Xn; R20/21/22 Xi; R36/38
2-Ethyl-1-hexanol	104-76-7				
2-Ethylfuran	3208-16-0				Xn; R22 (The Danish Environmental Protection Agency's guiding list)
2-Ethylhexanic acid	149-57-5		x		Rep3;R63
2-Ethylhexylacrylate	103-11-7				x Xi;R37/38 R43
2-methyl-1-propyl benzene	768-49-0				N; R50/53 (The Danish Environmental Protection Agency's guiding list)
2-Methylcyclopentanon	1120-72-5				Xn; R22 (The Danish Environmental Protection Agency's guiding list)
2-Pyrrolidinon	616-45-5				Xn; R22 (The Danish Environmental Protection Agency's guiding list)
3-Caren	13466-78-9				N; R51/53 (The Danish Environmental Protection Agency's guiding list)
Acetaldehyde	75-07-0	x			Fx;R12 Xi;R36/37 Carc3;R40
Acetophenon	98-86-2				Xn;R22 Xi;R36
alfa-Pinen	80-56-8				N;R50/53 (The Danish Environmental Protection Agency's guiding list)
Benzaldehyde	100-52-7				Xn;R22
Benzene	71-43-2	x			Carc3;R45 F;R11 T;R48/23/24/25
Benzoic acid	65-86-0				
Benzothiazol	95-16-9				x Xn;R22 R43(The Danish Environmental Protection Agency's guiding list)
Butanol	110-82-7				F;R11 Xi;R38 Xn;R65 R67 N;R50/53
Butyl format	592-84-7				F;R11 Xi;R36/37
Butylacetat	123-86-4				R10 R66 R67
Butyldiglycol	112-34-5				Xi;R36
Butyleret Hydroxytoluene	128-37-0				Xn;R22 N;R50/53 List of unwanted substances and the Danish Environmental Protection Agency's guiding list
Butyraldehyde	123-72-8				F;R11
Butyrolacton	96-48-0				

Substance	CAS nr.	C	T	M	S
C10 aromates	-				
C9-aromates	-				
Decahydronaphtalene	493-02-7				
Decanal	112-31-2				
Dibutylphthalate	84-74-2		x		Rep2;R61 Rep3;R62 N;R50
Acetic acid	64-19-7				R10 C;R35
Ethylacetate	141-78-6				F;R11 Xi;R36 R66 R67
Ethylbenzene	100-41-4	x			F;R11 Xn;R20, suspected carcinogenic
Ethylglycolacetate	111-15-9		x		Rep2;R60-61 Xn;R20/21/22
Formaldehyde	50-00-0	x			T;R23/24/25 C;R34 Carc3;R40 R43
Heptanic acid	111-14-8				C;R34
Hexane	110-54-3		x		F;R11 Xi;R38 Xn;R48/20-65 Rep3;R62 R67 N;R51/53
Hexanal	66-25-1				
Hexanic acid	142-62-1				
Hydroxyethylmethacrylate	868-77-9				x Xi;R36/38 R43
Isocyanic acid	75-13-8				
Kodaflex	6846-50-0				x R43 (The Danish Environmental Protection Agency's guiding list)
Hydrocarbons C10-C18	-				
Limonen	138-86-3				R10 X;;R38 R43 N;R50/53
Longifolen	103-11-7				x X;;R37/38 R43
Methoxy-phenyl oxime	1000222-86-6				
Methyl formal	109-87-5				
Methylisocyanate	624-83-9				x Fx;R12 T;R23/24/25 Xi;R36/37/38
Methylmethacrylate	80-62-6				F;R11 Xi;R37/38 R43 (List of unwanted substances)
Methylnaphtalene	90-12-0				
Naphtalene	91-20-3				Xn;R22 N;R50/53 (List of unwanted substances)
N-methylpyrrolidon	872-50-4				Xi;R36/38
Nonanal	124-19-6				N;R50 (The Danish Environmental Protection Agency's guiding list)
Nonanic acid	112-05-0				C;R34
Octanal	124-13-0				R10 Xi;R36/38
Octanic acid	124-07-2				
p-Cresol*	106-44-5				T;R24/25 C;R34
Pentanal	110-62-3				
Phenol	108-95-2				T;R24/25 C;R34 (List of unwanted substances)
Phenyl-1-buten	824-90-8				
Phthalic acid anhydride	85-44-9				x Xn;R22 Xi;R37/38-41 R42/43 (List of unwanted substances)
Propionaldehyde	123-38-6				F;R11 Xi;R36/37/38
Siloxanes	-				
Styrene	100-42-5				R10 Xn;R20 Xi;R36/38
Tetrahydrofuran	109-99-9				F;R11 R19 Xi;R36/37
Texanol	25265-77-4				
Toluene	108-88-3				F;R11 Xn;R20

Substance	CAS nr.	C	T	M	S
Trimethylsilanol	1066-40-6				
Xylene	106-42-3				R10 Xn;R20/21 Xi;R38

C: carcinogenic

T: teratogenic

M: mutagenic

S: sensitizing

Appendix 3

Outline of calculated room concentrations and risk factors for the tested products

Printer

Substance	CAS no.	GV mg/m ³	Source strength	Source strength	Room con.	Room con.	fs	fs
			Following 7 hours (µg/unit/hour)	Foll. 9 days (µg/unit/hour)	Following 7 hours mg/m ³	Foll. 9 days mg/m ³	7 hours	9 days
Acetic acid	64-19-7	25	34	<2	0,0039	<0,0005	0,02	<0,01
Limonen	5989-27-5	140	27	<2	0,0031	<0,0005	<0,01	<0,01
Siloxanes	-		22	<2	0,0025	<0,0005	<0,01	<0,01
3-Caren	13466-78-9	140	5,4	<2	0,0006	<0,0005	<0,01	<0,01
2-Ethylhexylacrylate	103-11-7	38	4	5,4	0,0005	0,0006	<0,01	<0,01
Formaldehyde	50-00-0	0	3,5	7,8	0,0004	0,0009	0,10	0,22
Hexanal	66-25-1	300	2,2	<2	0,0003	<0,0005	<0,01	<0,01
2-Pyrrolidinon	616-45-5		<2	61	<0,0005	0,0070	<0,01	<0,01
1,2-Hexandiol	6920-22-5		<2	24	<0,0005	0,0028	<0,01	<0,01

Oven

Substance	CAS no.	GV mg/m ³	Source strength	Source strength	Room con.	Room con.	fs	fs
			Following 7 hours (µg/unit/hour)	Foll. 9 days (µg/unit/hour)	Following 7 hours mg/m ³	Foll. 9 days mg/m ³	7 hours	9 days
Siloxanes	-		1100	290	0,126	0,033	<0,01	<0,01
2-butanon	78-93-3	145	990	400	0,114	0,046	0,08	0,03
Unidentified fluorin compounds	-		450	7,2	0,052	0,001	<0,01	<0,01
Formaldehyde	50-00-0	0,4	160	210	0,018	0,024	4,60	6,03
Hydrocarbons C10-C18	-	180	57	4,2	0,007	<0,001	<0,01	<0,01
3-Caren	13466-78-9	140	42	<5	0,005	<0,001	<0,01	<0,01
Nonanal	124-19-6		30	<5	0,003	<0,001	<0,01	<0,01
Butyraldehyde	123-72-8		27	27	0,003	0,003	<0,01	<0,01
Limonen	138-86-3	140	26	<5	0,003	<0,001	<0,01	<0,01
Benzene	71-43-2	1,6	18	<5	0,002	<0,001	0,13	<0,01
Octanal	124-13-0		18	<5	0,002	<0,001	<0,01	<0,01
Ethylhexanol	104-76-7	500	18	<5	0,002	<0,001	<0,01	<0,01
Benzoic acid	65-86-0		13	6,7	0,001	0,001	<0,01	<0,01
Phenol	108-95-2	4	13	<5	0,001	<0,001	0,04	<0,01
Nonanic acid	112-05-0		11	<5	0,001	<0,001	<0,01	<0,01
alfa-Pinen	80-56-8	140	10	7,8	0,001	0,001	<0,01	<0,01
C10-aromateer	-	137	10	<5	0,001	<0,001	<0,01	<0,01
Decanal	112-31-2	300	9,8	<5	0,001	<0,001	<0,01	<0,01
Diethylphthalate	84-66-2	3	8	<5	0,001	<0,001	0,03	<0,01
Styrene	100-42-5	105	7,8	<5	0,001	<0,001	<0,01	<0,01
2-Ethyl hexanic acid	149-57-5	100	6,1	<5	0,001	<0,001	<0,01	<0,01
Benzaldehyde	100-52-7		5,6	4,2	0,001	<0,001	<0,01	<0,01
C9-aromates	-	50	5,1	<5	0,001	<0,001	0,00	<0,01
Xylene	106-42-3	109	5	<5	0,001	<0,001	0,00	<0,01
Methylisocyanate	624-83-9	0,02	0,75	<5	0,000	<0,001	0,43	<0,01
Isocyanic acid	75-13-8	0,02	0,67	<5	0,000	<0,001	0,39	<0,01
Acetaldehyde	75-07-0	45	<3	120	<0,001	0,014	<0,01	0,03
Pentanal	110-62-3	175	<3	40	<0,001	0,005	<0,01	<0,01
Propionaldehyde	123-38-6	100	<3	22	<0,001	0,003	<0,01	<0,01

Hair dryer

Substance	CAS no.	GV mg/m ³	Source strength	Source strength	Room con.	Room con.	fs	fs
			Following 7 hours (µg/unit/hour)	Foll. 9 days (µg/unit/hour)	Following 7 hours mg/m ³	Foll. 9 days mg/m ³	7 hours	9 days
Hydrocarbons C12-C1	-	180	130	120	0,0149	0,0138	0,01	0,01
Xylene	106-42-3	109	11	15	0,0013	0,0017	<0,01	<0,01
Butylacetate	123-86-4	710	10	<3	0,0011	<0,0004	<0,01	<0,01
Dibutylphthalate	84-74-2	3	9	<3	0,0010	<0,0004	0,03	<0,01
Ethylbenzene	100-41-4	217	7,7	11	0,0009	0,0013	<0,01	<0,01
Butanol	110-82-7	150	5,6	14	0,0006	0,0016	<0,01	<0,01
Limonen	5989-27-5	140	5,3	<3	0,0006	<0,0004	<0,01	<0,01
Tetrahydrofuran	109-99-9	148	4,6	<3	0,0005	<0,0004	<0,01	<0,01
Benzothiazol	95-16-9		4,5	6,7	0,0005	0,0008	<0,01	<0,01
Formaldehyde	50-00-0	0,4	4,2	5,8	0,0005	0,0007	0,12	0,17
Ethylglycolacetate	111-15-9	27	4	6,4	0,0005	0,0007	<0,01	<0,01
Ethylhexanol	104-76-7	500	4	<3	0,0005	<0,0004	<0,01	<0,01
Butyraldehyd	123-72-8		3,8	<5	0,0004	<0,0005	<0,01	<0,01
3-Caren	13466-78-9	140	2,4	<3	0,0003	<0,0004	<0,01	<0,01
Phenyl-1-buten	824-90-8		<2	2,2	<0,0003	0,0003	<0,01	<0,01
Styrene	100-42-5	105	<2	1,8	<0,0003	0,0002	<0,01	<0,01
C10 aromates	-	137	<2	1,8	<0,0003	0,0020	<0,01	<0,01

Iron

Substance	CAS no.	GV mg/m ³	Source strength	Source strength	Room con.	Room con.	fs	fs
			Following 7 hours (µg/unit/hour)	Foll. 9 days (µg/unit/hour)	Following 7 hours mg/m ³	Foll. 9 days mg/m ³	7 hours	9 days
Hydrocarbons C6-C18	-	180	230	16	0,0264	0,0018	0,01	<0,01
Siloxanes	-		100	25	0,0115	0,0029	<0,01	<0,01
Formaldehyde	50-00-0	0,4	29	0,06	0,0033	0,0000	0,83	<0,01
Toluene	108-88-3	94	25	0,64	0,0029	0,0001	<0,01	<0,01
Acetaldehyde	75-07-0	45	18	<1	0,0021	<0,0002	<0,01	<0,01
Trimethylsilanol	1066-40-6		16	<1	0,0018	<0,0002	<0,01	<0,01
Butanol	110-82-7	150	24	0,91	0,0028	0,0001	<0,01	<0,01
Phenol	108-95-2	4	12	1,5	0,0014	0,0002	0,03	<0,01
Tetrahydrofuran	109-99-6	148	9,6	<1	0,0011	<0,0002	<0,01	<0,01
Hexanal	66-25-1	300	5,3	<0,3	0,0006	<0,0002	<0,01	<0,01
1,1-Phenylen-bis-ethanon	1009-61-6		5	3,8	0,0006	0,0004	<0,01	<0,01
Methoxy-phenyl oxime	-		4,5	1,2	0,0005	0,0001	<0,01	<0,01
N-methylpyrrolidon	872-50-4	20	4,4	<1	0,0005	<0,0002	<0,01	<0,01
C9-aromates	-	50	2,5	<1	0,0003	<0,0002	<0,01	<0,01
Butyrolacton	96-48-0	176	2,1	<1	0,0002	<0,0002	<0,01	<0,01
Benzaldehyde	100-52-7		1,5	<0,3	0,0002	<0,0001	<0,01	<0,01
Butyraldehyde	123-72-8		1,3	<0,3	0,0001	<0,0001	<0,01	<0,01
Acetophenon	98-86-2	49	0,89	<0,5	0,0001	<0,0001	<0,01	<0,01

Lamp

Substance	CAS no.	GV mg/m ³	Source strength	Source strength	Room con.	Room con.	fs	fs
			Following 7 hours (µg/unit/hour)	Foll. 9 days (µg/unit/hour)	Following 7 hours mg/m ³	Foll. 9 days mg/m ³	7 hours	9 days
Xylene	106-42-3	109	200	41	0,0230	0,0047	0,02	<0,01
Ethylbenzene	100-41-4	217	180	28	0,0207	0,0032	0,01	<0,01
Formaldehyde	50-00-0	0,4	170	43	0,0195	0,0049	4,89	1,24
Butanol	110-82-7	150	260	88	0,0299	0,0101	0,02	0,01
Hexanal	66-25-1	300	79	14	0,0091	0,0016	<0,01	<0,01
Toluene	108-88-3	94	58	8,6	0,0067	0,0010	0,01	<0,01
C9-aromates	-	50	38	<2	0,0044	<0,0002	0,01	<0,01
Pentanal	110-62-3	175	25	7,9	0,0029	0,0009	<0,01	<0,01
Butyraldehyde	100-52-7		24	4,6	0,0028	0,0005	<0,01	<0,01
C10-aromates	-	137	21	<2	0,0024	<0,0002	<0,01	<0,01
Acetophenon	98-86-2	49	12	<2	0,0014	<0,0002	<0,01	<0,01
Acetaldehyde	75-07-0	45	10	2	0,0011	0,0002	<0,01	<0,01
Methyl formal	109-87-5		6,4	<2	0,0007	<0,0002	<0,01	<0,01
Propionaldehyde	123-38-6	100	5,8	1,1	0,0007	0,0001	<0,01	<0,01
Butyl format	592-84-7		5	1,4	0,0006	0,0002	<0,01	<0,01
Styrene	100-42-5	105	2,6	<2	0,0003	<0,0002	<0,01	<0,01
2-Ethylfuran	3208-16-0		0,56	<2	0,0001	<0,0002	<0,01	<0,01
Ethylhexanol	104-76-7	500	<2	6,3	<0,0002	0,0007	<0,01	<0,01
Benzaldehyde	100-52-7		9,4	<2	0,0011	<0,0002	<0,01	<0,01

Mobil phone 1 (without charger)

Substance	CAS no.	GV mg/m ³	Source strength	Source strength	Room con.	Room con.	fs	fs
			Following 7 hours (µg/unit/hour)	Foll. 9 days (µg/unit/hour)	Following 7 hours mg/m ³	Foll. 9 days mg/m ³	7 hours	9 days
Toluene	108-88-3	94	29	<1	0,0033	<0,0001	<0,01	<0,01
Siloxanes	-		1,6	<1	0,0002	<0,0001	<0,01	<0,01

Mobil phone 2 (with charger)

Substance	CAS no.	GV mg/m ³	Source strength	Source strength	Room con.	Room con.	fs	fs
			Following 7 hours (µg/unit/hour)	Foll. 9 days (µg/unit/hour)	Following 7 hours mg/m ³	Foll. 9 days mg/m ³	7 hours	9 days
Toluene	108-88-3	94	17	<1	0,0020	<0,0001	<0,01	<0,01
Siloxanes	-		2,1	<1	0,0002	<0,0001	<0,01	<0,01
Butylated Hydroxytoluene	128-37-0	10	1,3	<1	0,0001	<0,0001	<0,01	<0,01
Xylene	106-42-3	109	1,1	<1	0,0001	<0,0001	<0,01	<0,01
Hexanal	66-25-1	300	0,21	<0,4	<0,0001	<0,0001	<0,01	<0,01
Acetaldehyde	75-07-0	45	0,061	<0,4	<0,0001	<0,0001	<0,01	<0,01
Formaldehyde	50-00-0	0,4	0,017	<0,2	<0,0001	<0,0001	<0,01	<0,01

PC

Substance	CAS no.	GV mg/m ³	Source strength	Source strength	Room con.	Room con.	fs	fs
			Following 7 hours (µg/enhed/time)	Foll. 9 days (µg/enhed/time)	Following 7 hours mg/m ³	Foll. 9 days mg/m ³	7 hours	9 days
Hydrocarbons C8-C15	-	180	480	260	0,0552	0,0299	0,03	0,02
Phenol	108-95-2	4	140	140	0,0161	0,0161	0,40	0,40
C10-aromates	-	137	130	46	0,0149	0,0053	0,01	<0,01
Xylene	106-42-3	109	91	75	0,0105	0,0086	0,01	0,01
Butanol	110-82-7	150	66	88	0,0076	0,0101	0,01	0,01
Ethylbenzene	100-41-4	217	66	51	0,0076	0,0059	<0,01	<0,01
C9-aromates	-	50	42	22	0,0048	0,0025	0,01	0,01
Ethylhexanol	104-76-7	500	37	30	0,0043	0,0034	<0,01	<0,01
Formaldehyde	50-00-0	0,4	29	32	0,0033	0,0037	0,83	0,92
Acetophenon	96-86-7	49	27	18	0,0031	0,0021	0,01	<0,01
Ethylhexylacrylate	103-11-7	38	27	30	0,0031	0,0034	0,01	0,01
Siloxanes	-	-	26	40	0,0030	0,0046	<0,01	<0,01
Styrene	100-42-5	105	22	16	0,0025	0,0018	<0,01	<0,01
2-Ethylhexanic acid	149-57-5	-	15	<2	0,0017	<0,0002	<0,01	<0,01
Butyldiglycol	112-34-5	100	14	2,8	0,0016	0,0003	<0,01	<0,01
Tetrahydrofuran	109-99-9	148	14	24	0,0016	0,0028	<0,01	<0,01
2-Butoxyethanol	111-76-2	98	13	<2	0,0015	<0,0002	<0,01	<0,01
2,3-Dihydro-4-methyl-1H-Inden	824-22-6	-	13	4,5	0,0015	0,0005	<0,01	<0,01
Naphtalene	91-20-3	50	11	5,8	0,0013	0,0007	<0,01	<0,01
alfa-Pinen	108-95-2	140	11	12	0,0013	0,0014	<0,01	<0,01
p-Cresol	106-44-5	175	10	8,3	0,0011	0,0010	<0,01	<0,01
Acetaldehyde	75-07-0	45	7,5	8,8	0,0009	0,0010	<0,01	<0,01
Butyleret hydroxytoluene	475-20-7	10	7,4	8,3	0,0009	0,0010	0,01	0,01
Longifolen	103-11-7	140	6,6	2,6	0,0008	0,0003	<0,01	<0,01
Hexanal	66-25-1	300	6,2	<2	0,0007	<0,0002	<0,01	<0,01
1,6-dichlorocyclooctadien	29480-42-0	-	5,9	<2	0,0007	<0,0002	<0,01	<0,01
Hydroxyethylmethacrylate	868-77-9	147	5,6	3,5	0,0006	0,0004	<0,01	<0,01
Methylnaphtalene	90-12-0	-	5,1	<2	0,0006	<0,0002	<0,01	<0,01
Propionaldehyde	123-38-6	100	5	<2	0,0006	<0,0002	<0,01	<0,01
Kodaflex	6846-50-0	-	4	<2	0,0005	<0,0002	<0,01	<0,01
2-Methylcyclopentanon	1120-72-5	-	2,6	<2	0,0003	<0,0002	<0,01	<0,01
Decahydronaphtalene	493-02-7	134	2,1	<2	0,0002	<0,0002	<0,01	<0,01
Ethylacetate	141-78-6	540	<2	12	<0,0002	0,0014	<0,01	<0,01
Butylglycol	111-76-2	98	<2	6,6	<0,0002	0,0008	<0,01	<0,01
Benzaldehyde	100-52-7	-	<2	4,1	<0,0002	0,0005	<0,01	<0,01
3-Caren	13466-78-9	140	<2	2,7	<0,0002	0,0003	<0,01	<0,01

TV

Substance	CAS no.	GV mg/m ³	Source strength	Source strength	Room con.	Room con.	fs	fs
			Following 7 hours (µg/enhed/time)	Foll. 9 days (µg/enhed/time)	Following 7 hours mg/m ³	Foll. 9 days mg/m ³	7 hours	9 days
Phenol	108-95-2	4	30	<2	0,0034	<0,0003	0,09	<0,01
2-Butoxyethanol	111-76-2	98	24	16	0,0028	0,0018	<0,01	<0,01
Hydrocarbons C9-C16	-	180	20	9,4	0,0023	0,0011	<0,01	<0,01
Styrene	100-42-5	105	13	7,7	0,0015	0,0009	<0,01	<0,01
Formaldehyde	50-00-0	0,4	13	<1	0,0015	<0,0003	0,37	<0,01
Xylene	106-42-3	109	10	<2	0,0011	<0,0003	<0,01	<0,01
Limonen	5989-27-5	140	10	<2	0,0011	<0,0003	<0,01	<0,01
Methylmethacrylate	80-62-6	102	6,9	<2	0,0008	<0,0003	<0,01	<0,01
alfa-Pinen	108-95-2	140	5,8	<2	0,0007	<0,0003	<0,01	<0,01
Hexanic acid	142-62-1		5,8	6,7	0,0007	0,0008	<0,01	<0,01
C9-aromates	-	50	5,6	<2	0,0006	<0,0003	<0,01	<0,01
Acetaldehyde	75-07-0	45	5,4	<2	0,0006	<0,0003	<0,01	<0,01
2-Ethyl-1-hexanol	104-76-7	500	5,3	<2	0,0006	<0,0003	<0,01	<0,01
Benzaldehyde	100-52-7		5	<2	0,0006	<0,0003	<0,01	<0,01
3-Caren	13466-78-9	140	4,3	<2	0,0005	<0,0003	<0,01	<0,01
Butyraldehyde	123-72-8		4	<2	0,0005	<0,0003	<0,01	<0,01
1-Ethenyl-4-ethyl benzene	03454-07-7		3,7	<2	0,0004	<0,0003	<0,01	<0,01
Ethylbenzene	100-41-4	217	3,2	<2	0,0004	<0,0003	<0,01	<0,01
Texanol	25265-77-4		3,2	2,6	0,0004	0,0003	<0,01	<0,01
Phthalic acid anhydride	85-44-9	1	3	<2	0,0003	<0,0003	<0,01	<0,01
Naphtalene	91-20-3	50	1,9	<2	0,0002	<0,0003	<0,01	<0,01
Diethylphthalate	84-66-2	3	1,9	<2	0,0002	<0,0003	0,01	<0,01
2-methyl-1-propyl benzene	768-49-0	135	1,7	<2	0,0002	<0,0003	<0,01	<0,01

El-panel

Substance	CAS no.	GV mg/m ³	Source strength Following 7 hours (µg/enhed/time)	Source strength Foll. 9 days (µg/enhed/time)	Room con. Following 7 hours mg/m ³	Room con. Foll. 9 days mg/m ³	fs 7 hours	fs 9 days
2-Ethylhexanol	104-76-7	98	5	2,3	0,0006	0,0003	<0,01	0,01
Hydrocarbons C11-C14	-	180	0,5	<1	0,0001	<0,0002	<0,01	<0,01
alfa-Pinen	108-95	140	0,42	<1	<0,0001	<0,0002	<0,01	<0,01
Longifolen	103-11-7	140	0,26	<1	<0,0001	<0,0002	<0,01	<0,01
Formaldehyde	50-00-0	0,4	0,06	0,5	<0,0001	0,0001	<0,01	0,10
Acetaldehyde	75-07-0	45	0,06	<0,1	<0,0001	<0,0001	<0,01	<0,01

El-radiator

Substance	CAS no.	GV mg/m ³	Source strength	Source strength	Room con.	Room con.	fs	fs
			Following 7 hours (µg/enhed/time)	Foll. 9 days (µg/enhed/time)	Following 7 hours mg/m ³	Foll. 9 days mg/m ³	7 hours	9 days
Hydrocarbons C6-C11	-	180	14	<2	0,0016	<0,0002	<0,01	<0,01
Acetophenon	98-86-2	49	14	13	0,0016	0,0015	<0,01	0,01
Propionaldehyde	123-38-6	100	9,1	<2	0,0010	<0,0002	<0,01	<0,01
Siloxanes	-		9	<2	0,0010	<0,0002	<0,01	<0,01
Acetic acid	64-19-7	25	7,4	<2	0,0009	<0,0002	<0,01	<0,01
Hexan	110-54-3	700	7,2	<2	0,0008	<0,0002	<0,01	<0,01
Butylacetate	123-86-4	710	4,8	<2	0,0006	<0,0002	<0,01	<0,01
Hexanic acid	142-62-1		4,8	<2	0,0006	<0,0002	<0,01	<0,01
Heptanic acid	111-14-8		4,8	<2	0,0006	<0,0002	<0,01	<0,01
Nonanic acid	112-05-0		4,3	<2	0,0005	<0,0002	<0,01	<0,01
Formaldehyde	50-00-0	0,4	3,8	3,2	0,0004	0,0004	0,11	0,01
Acetaldehyde	75-07-0	45	3,7	<2	0,0004	<0,0002	<0,01	<0,01
Octanic acid	124-07-2		2,6	<2	0,0003	<0,0002	<0,01	<0,01

Rechargeable batteries

Substance	CAS no.	GV mg/m ³	Source strength	Source strength	Room con.	Room con.	fs	fs
			Following 7 hours (µg/unit/hour)	Foll. 9 days (µg/unit/hour)	Following 7 hours mg/m ³	Foll. 9 days mg/m ³	7 hours	9 days
Xylene	106-42-3	109,00	170	46	0,0195	0,0053	0,02	<0,01
Ethylbenzene	100-41-4	217	140	34	0,0161	0,0039	0,01	<0,01
C9-aromates	-	50	83	24	0,0095	0,0028	0,02	<0,01
Toluene	108-88-3	94	77	9,4	0,0089	0,0011	0,01	<0,01
C10-aromates	-	137	13	1,2	0,0015	0,0001	<0,01	<0,01
Hydrocarbons C8-C14	-	180	8,3	<1	0,0010	<0,0001	<0,01	<0,01
Styrene	100-42-5	105	7,2	1,4	0,0008	0,0002	<0,01	<0,01
Acetophenon	98-86-2	49	1,8	<1	0,0002	<0,0001	<0,01	<0,01
Benzaldehyde	100-52-7		0,94	<1	0,0001	<0,0001	<0,01	<0,01
Hexanal	66-25-1	300	0,83	<1	0,0001	<0,0001	<0,01	<0,01
Limonen	5989-27-5	140	0,77	<1	0,0001	<0,0001	<0,01	<0,01
Propionaldehyde	123-38-6	100	0,37	2,3	<0,0001	0,0003	<0,01	0,07
Formaldehyde	50-00-0	0,4	0,22	0,28	<0,0001	<0,0001	0,01	0,01
Acetaldehyde	75-07-0	45	0,16	<1	<0,0001	<0,0001	<0,01	<0,01

Appendix 4

Outline of applied limit values with specification of sources

Substance	CAS no	GV	Source
1,1-Phenylen-bis-ethanon	1009-61-6		
1,2-Hexandiol	6920-22-5		
1,6-dichlorocyclooctadien	29480-42-0		
1-Ethenyl-4-ethyl benzene	03454-07-7		
2-(2-ethoxyethoxyethanol)	111-90-0	11	2
2,3-Dihydro-4-methyl-1H-Inden	824-22-6		
2-butanon	78-93-3	145	1
2-Butoxyethanol	111-76-2	98	1
2-Ethyl-1-hexanol	104-76-7	500	2
2-Ethylfurane	3208-16-0		
2-Ethylhexanic acid	149-57-5	100	2
2-Ethylhexylacrylate	103-11-7	38	1a
2-methyl-1-propyl benzene	768-49-0	135	1a
2-Methylcyclopentanon	1120-72-5		
2-Pyrrolidinon	616-45-5		
3-Caren	13466-78-9	140	1
Acetaldehyde	75-07-0	45	1
Acetophenon	98-86-2	49	1
alfa-Pinen	80-56-8	140	1
Benzaldehyde	100-52-7		
Benzene	71-43-2	1,6	1
Benzoic acid	65-86-0		
Benzothiazol	95-16-9		
Butanol	110-82-7	150	1
Butyl formate	592-84-7		
Butylacetate	123-86-4	710	1
Butyldiglycol	112-34-5	100	1
Butyleret Hydroxytoluene	128-37-0	10	2
Butyraldehyde	123-72-8		
Butyrolactone	96-48-0	176	1a
C10 aromates	-	137	1a
C9-aromates	-	50	1a
Decahydronaphtalene	493-02-7	134	1a
Decanal	112-31-2	300	2
Dibutylphthalate	84-74-2	3	1
Acetic acid	64-19-7	25	1
Ethylacetate	141-78-6	540	1
Ethylbenzene	100-41-4	217	1
Ethylglycolacetate	111-15-9	27	1
Formaldehyde	50-00-0	0,4	1
Heptanic acid	111-14-8		
Hexane	110-54-3	700	1
Hexanal	66-25-1	300	2
Hexanic acid	142-62-1		
Hydroxyethylmethacrylate	868-77-9		
Isocyanic acid	75-13-8	0,02	3
Kodaflex	6846-50-0		

Substance	CAS no	GV	Source
Hydrocarbons C10-C18	-	180	1
Limonen	138-86-3	140	1
Longifolen	103-11-7	140	1
Methoxy-phenyl oxime	0		
Methyl formal	109-87-5		
Methylisocyanate	624-83-9	0,02	3
Methylmethacrylate	80-62-6	102	1
Methylnaphthalene	90-12-0		
Naphtalene	91-20-3	50	1
N-methylpyrrolidon	872-50-4	20	1
Nonanal	124-19-6		
Nonanic acid	112-05-0		
Octanal	124-13-0		
Octanic acid	124-07-2		
p-Cresol	106-44-5	22	1
Pentanal	110-62-3	175	1
Phenol	108-95-2	4	1
Phenyl-1-buten	824-90-8		
Phthalic acid anhydride	85-44-9	1	1
Propionaldehyde	123-38-6	100	2
Siloxanes	-		
Styrene	100-42-5	105	1
Tetrahydrofuran	109-99-9	148	1
Texanol	25265-77-4		
Toluene	108-88-3	94	1
Trimethylsilanol	1066-40-6		
Xylene	106-42-3	109	1

1: At-Guideline C.0.1 (October 2002)

1a: Tentative list; At-guideline C.0.1 (October 2002)

2: Mapping no 32, Miljøstyrelsen 2003

3: Occupational Exposure Limits 2002, EH40/2002 (HSE)

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