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INTERA BTEX case study

Dimosthenis Sarigiannis
Alberto Gotti
Spyros Karakitsios
Periklis Kontoroupis
Spyridoula Nikolaki

CEntre for Research and Technology Hellas (CERTH)

Chemical Process Engineering Research Institute

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INTRODUCTION

What is BTEX?

Benzene, toluene, ethylbenzene, and xylene (BTEX) are volatile mono-aromatic hydrocarbons commonly found together in gasoline and are common VOC components of outdoor and indoor air mixtures due to their widespread use in many commercial products. Vehicle exhaust is considered to be the main source but non-professional use of paints, glues, adhesives, varnishes, lacquers, shoe polish and cigarette smoke contribute significantly to the levels of these four VOCs in the indoor environment and to personal exposure.

Table 1. BTEX identification

Chemical name	CAS No	Formula	MW	log Kow
Benzene	71-43-2	C_6H_6	78.11	134.896
Toluene	108-88-3	C_7H_8 or $C_6H_5CH_3$	92.14	446.684
Ethylbenzene	100-41-4	C_8H_{10}	106.17	1348.963
Xylenes	1330-20-7	$C_6H_4C_2H_6$	106.16	

How are people exposed to BTEX?

Exposure in the indoor environment is dominated by inhalation. As BTEX is not is not one chemical, but rather a quaternary mixture of chemicals, exposure to BTEX involves a multi-chemical approach which has to take into account possible interactions between the four substances.

According to the benzene EU Risk Assessment Reports (RAR) (ECB 2008) inhalation represents the only important exposure route associated to benzene exposure in indoor locations, since the oral route would only be associated with accidents and dermal exposure may occur when a person is filling the tank of a car at a filling station and gasoline splashes, or when using benzene as a solvent in shoe making factories. It has been concluded that both these exposure routes could be neglected for indoor exposure assessment and can be neglected for risk characterization. This is also valid for the other VOC's (TEX) considered herein as the general population is exposed to them mainly through inhalation of vapor in ambient air and cigarette smoking.

Health effects

Each of the chemicals in the mixture of concern is volatile, well absorbed, extensively metabolized, and does not persist in the body for long periods of time. All of the BTEX chemicals can produce neurological impairment, and exposure to benzene can additionally cause hematological effects including acute myelogenous leukemia.

The carcinogenic (leukemogenic) potential of benzene is well established as indicated by its consensus classification as a human carcinogen by the National Toxicology Program, U.S. Environmental Protection Agency (USEPA 2001), and International Agency for Research on Cancer (IARC 1987). Ethylbenzene is possibly carcinogenic to humans based on a recent assessment by IARC (IARC 2000). Toluene and xylenes have been categorized as not classifiable as to human carcinogenicity by both EPA (2001) and IARC (1999; 1999), reflecting the lack of evidence for the carcinogenicity of these two chemicals.

Guidelines

Reference Exposure Limits (REL) for the BTEX regarding acute and chronic effects are given by OEHHA and EPA (USEPA 2009) and the respective values are presented in Table 2.

Table 2. Reference Exposure Limit values (µg m^{-3}) for the BTEX compounds

	REL values (µg m^{-3})			
	EPA		**OEHHA**	
	Acute	***Chronic***	***Acute***	***Chronic***
Benzene		**30**	**1300**	**60**
Toluene		**400**	**37000**	**300**
Ethylbenzene				**2000**
Xylene		**100**	**22000**	**700**

Guidelines about benzene in the indoor air have been set by the Flanders region in Belgium and in China, but there is a big difference in the values recommended by these two countries; in Flanders a target value of 2 µg/m³ and a limit value of 10 µg/m³ have been set whereas in China a guideline value of 90 µg/m^3 has been set.

Guideline values for toluene have been set in Germany (3 µg/m^3) and in Flanders, Belgium (260 µg/m^3) as target value. Similarly to benzene, the upper limits set by these two countries vary significantly.

Step 1: Scope of the case study

The overall scope of the BTEX case study is to apply the full-chain methodology to a mixture of chemicals (rather than to a single chemical) to derive population exposure levels to BTEX (both external and internal) in indoor settings according to different geographical locations in Europe. The exposure pathway taken into account is inhalation.

One of the main objectives of this case study is to assess how simultaneous exposure to the four VOC's composing the mixture can modify the biologically effective dose (BED) of each chemical resulting in more than a simple additive effect (the so-called 'cocktail effect') through metabolic interactions which can alter tissue dosimetry, and thereby the toxicity of mixture components resulting in lower toxicity (antagonism) or greater toxicity (synergism) of mixtures than would be expected from the individual chemicals.

To apply the full chain methodology we will follow the steps outlined in Figure 1 and hereinafter summarized:

Emissions → Concentrations in air → External exposure → Internal exposure (dose).

The case study will start from collecting data on emission rates from consumer products which feed the indoor air quality (IAQ) to derive the indoor air concentration. Data regarding typical indoor characteristics such as locations volumes and Air Exchange Rate (AER), will be also collected as they are needed as input data to the IAQ modeling. This first step will also serve as first check on the reliability and completeness of the collected data as well as of the IAQ results to reproduce the existing air concentration levels.

Whenever emission data are incomplete or not available the full chain approach outlined is flexible enough to allow starting from concentration values rather than from emission values.

Then external exposure levels will be derived combining indoor air concentration levels (either calculated or measured) with time activity data.

Regarding the internal exposure step, there is strong evidence that cancer risk in humans associated with exposure and benzene mostly results from metabolites of benzene formed internally. On this basis the use of a Physiologically-based Pharmacokinetic (PBPK) model to evaluate the internal doses in the target tissues allows the estimation of the appropriate exposure metric related to the exposure to the quaternary mixture. Furthermore, PBPK models have the unique capability to take into account the interaction between chemicals using a full mechanistic approach thus allowing the quantification of the effect of co-exposure on the internal doses of each chemical.

Geographical stratification

Indoor air concentration levels of BTEX have been collected for many different cities and regions in Europe allowing a good geographic differentiation. The inventory of BTEX indoor concentrations is given in Appendix 1 (Sarigiannis et al, 2011).

As far as the parameters entering in the IAQ model some of them are already in the KMS and they are differentiated according the geographic locations. They are:

- <u>Residence volumes</u>
- <u>Indoor-outdoor air exchange rates</u>
- <u>Outdoor concentrations</u>

- Data on <u>emission rates</u> from consumer products have been collected.
- <u>Time activity data</u> entering the exposure modeling are also stored in the KMS according with geographical location.
- Data on <u>use frequencies</u> of consumer products have been collected. No certain information about its geographical stratification is currently known.

<u>Parameters and variables entering the PBPK</u> model are already collected and implemented in the PBPK model. These data are automatically scaled to bodyweight so that separate results can be obtained for children and adults.

In the next sections a detailed analysis of the data requirements is provided highlighting also the data gaps. These sections are reported following the same order of the different steps encompassing the full-chain methodology.

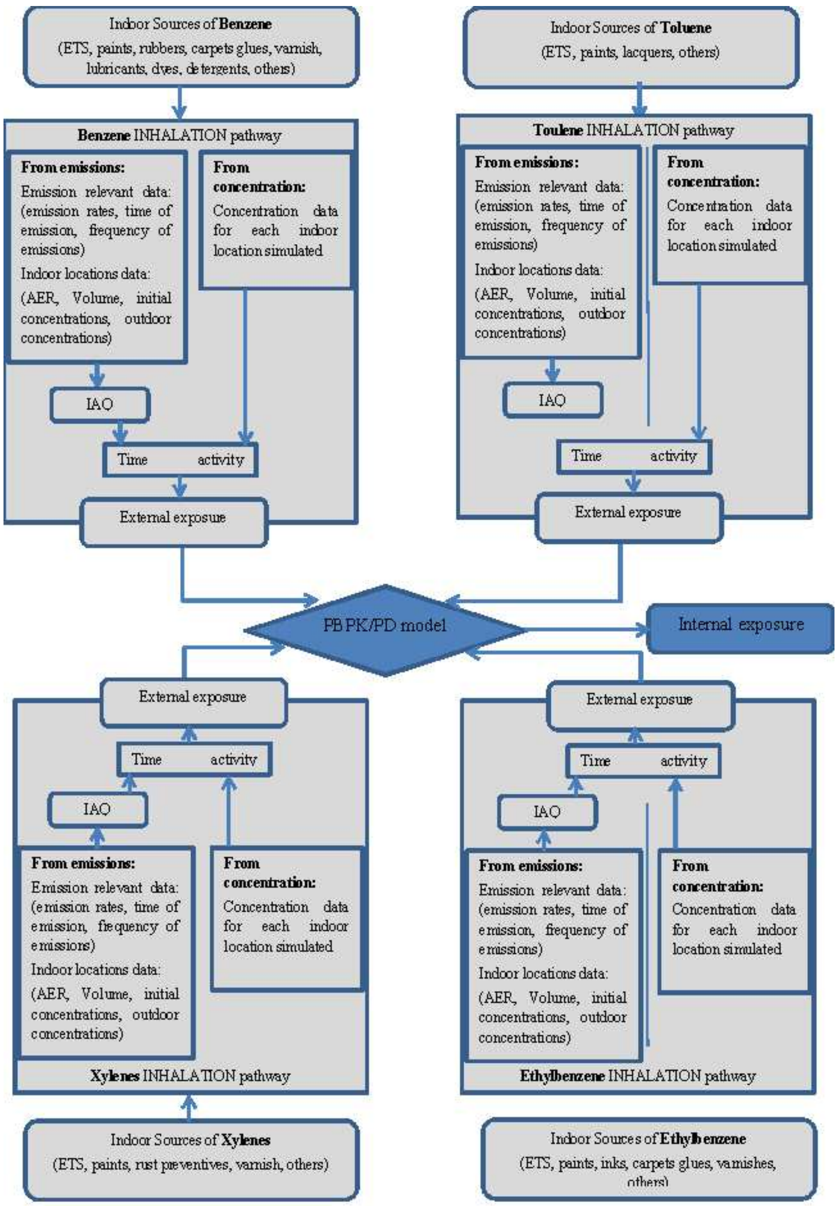

Figure 1. Methodological frame of BTEX case study

Step 2: Identification of the main sources of emission (products) in residential settings

Emission Data

Benzene can be found in gasoline and in products such as synthetic rubber, plastics, insecticides, paints, dyes, resins-glues, furniture wax, detergents and cosmetics.

Auto exhaust and industrial emissions account for about 20% of the total exposure to benzene in the EU. Benzene can also be found in cigarette smoke. Roughly about 50% of the exposure to benzene results from smoking tobacco or from secondhand exposure to tobacco smoke (Karakitsios, et al. 2010).

Toluene occurs naturally as a component of many petroleum products. Toluene is used as a solvent for paints, coatings, gums, oils and resins.

Ethylbenzene is used mostly as a gasoline and aviation fuel additive. It may also be present in consumer products such as paints, inks, plastics and pesticides.

There are three forms of **Xylene**: ortho-, meta-, and para-. Ortho-xylene is the only naturally-occurring form of xylene; the other two forms are man-made. Xylenes are used in gasoline and as a solvent in printing, rubber and leather industries.

Table 3 provides an overview of the main consumer products emitting BTEX

Table 3. Main consumer products emitting BTEX

Chemical	Consumer products
BTEX	Solvents in products such as paints and coatings building materials, and constituents of petroleum products, particularly *gasoline* and *kerosene*. Tobacco smoke.
Benzene	Rubbers, lubricants and abrasives, dyes, paint products, detergents, tobacco smoke, furniture wax, grease cleaners, stain removers, fast drying inks, perfumes, foam insulation, building materials and furnishings, solvent, artificial leather.
Toluene	*Gasoline, kerosene*, paints, and lacquers, nail polish or nail polish remover floor and furniture polish and cleaners, and tobacco smoke, adhesive films, architectural coatings, household hard surface cleaners, industrial particleboard, gravure inks, leather dressings and finishes, ironing and dry cleaning aids, inks, synthetic resins and rubber adhesives, shoe polishes and cleaners, line coloring pens and markers and tobacco smoke
Ethylbenzene	*Gasoline*, paints and inks, carpet glues, varnishes and paints, bathroom tube and tile cleaners, building and construction plastic foam insulation, floor and furniture polish, rubber floor and wall coverings, oven cleaners, cleaning and sanitation products, sheet vinyl flooring, waterproof compounds, wood office furniture and tobacco smoke
Xylenes	*Gasoline*, paint, varnish, rust preventives architectural coatings, epoxy adhesives, floor polish, household hard surface cleaners, lubricating oils, caulking compounds and sealants, ironing and dry cleaning aids, polishing preparations and related products, cleaning and sanitation products and tobacco smoke

BTEX emissions

Previous studies demonstrated that vehicular emissions and industrial sources are the major sources of ambient VOCs (Chan, et al. 2002; Ho, et al. 2002; Karakitsios, et al. 2006; Pfeffer 1994; Scheff and Wadden 1991; Vega, et al. 2000), while the sources of VOCs are quite numerous within any indoor environment. These sources include combustion by-products, cooking, construction materials, furnishings, paints, varnishes and solvents, adhesives and caulks and office equipment.

Emission rates in consumer products and building materials, for Benzene, Toluene, Ethylbenzene, Xylene have been reviewed from literature and they have been summarized in Table 4 to Table 8.

For Benzene, emission rates were identified in one building material (painted sheetrock) and 2 consumer products (Mosquito repellents and Tobacco smoke). In accordance, variation in the Mosquito repellents ranged between 10 $\mu g \cdot h^{-1}$ in mat and 540 $\mu g \cdot h^{-1}$ coil.

For Toluene, emission rates were found in 3 consumer products and 5 building materials. The highest emission rate in the consumer products was in Mosquito repellents (350 $\mu g \cdot h^{-1}$, point source). Regarding building materials, the highest emission was found in Vinyl flooring (6.7 $\mu g \cdot h^{-1} \cdot m^{-2}$) and the lowest in the Particle board with carpet (0.061 $\mu g \cdot h^{-1} \cdot m^{-2}$).

For Ethylbenzene, emission rates were found in 4 consumer products and 1 building material. It should be noted that the emission rate for Ethylbenzene, in the Mosquito repellent was identified to be the highest amongst the other pollutants (Benzene, Toluene, Ethylbenzene, Xylene).

Lastly, differences in the emission rates between the Xylene forms (the m,p-Xylene and the o-Xylene) were identified. Specifically, in the Tobacco smoke, the emission rate for the m,p-Xylene is 300 μg/cig, higher when compared to the emission rate for the o-Xylene 67 μg/cig. For the m,p-Xylene the highest emission rate was for the Vinyl flooring (5.3 $\mu g \cdot h^{-1} \cdot m^{-2}$) after 48 hours. The lowest emission was in the wallpaper adhesive assembly (0.11 $\mu g \cdot h^{-1} \cdot m^{-2}$) after 250 hours.

For o-Xylene the highest and the lowest values for the building materials were in vinyl flooring (6.3 $\mu g \cdot h^{-1} \cdot m^{-2}$ after 48 hours) and the glued wall paper (0.39 $\mu g \cdot h^{-1} \cdot m^{-2}$), respectively.

Emission rates from consumer products

Table 4. Benzene emission rates from building materials and various consumer products

Source	Emission rate	Country	Reference
Painted sheetrock	7.2 ± 1.74 ($\mu g \cdot h^{-1} \cdot m^{-2}$)	USA	(Wallace, et al. 1987)
Mosquito repellent /coil	540 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Mosquito repellent /liquid vaporiser	30 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Mosquito repellent /mat	10 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Tobacco smoke	90 ($\mu g\ cig^{-1}$)	USA	(IARC 2004)

Table 5. Toluene emission rates from building materials and various consumer products

Source	Emission rate	Country	Reference
Mosquito repellent /coil	350 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Mosquito repellent /liquid vaporiser	270 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Mosquito repellent /mat	10 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Particle board with carpet	0.061 ($\mu g \cdot h^{-1} \cdot m^{-2}$)	USA	(USEPA 1993)
Synthetic rubber adhesive	0.59 ($\mu g \cdot h^{-1} \cdot m^{-2}$)	USA	(USEPA 1993)

(for walls and ceilings)			
Synthetic rubber adhesive (for vinyl carpet)	62 ($\mu g \cdot h^{-1} \cdot m^{-2}$)	USA	(USEPA 1993)
Unspecified polymer adhesive (for subflooring)	2.4-2.6 ($\mu g \cdot h^{-1} \cdot m^{-2}$)	USA	(USEPA 1993)
Carpets	<3 ($\mu g \cdot h^{-1} \cdot m^{-2}$) after 48h	USA	(USEPA 1999)
Tobacco smoke	660 ($\mu g \cdot cig^{-1}$) (from 6 commercial brands in USA)	USA	(Hodgson, et al. 1996)
Wallpaper/adhesive assembly	2.67 ($\mu g \cdot h^{-1} \cdot m^{-2}$) after 250 h	Korea	(Choi, et al. 2010)
Plywood flooring/ adhesive assembly	1.93 ($\mu g \cdot h^{-1} \cdot m^{-2}$) after 227 h	Korea	(Choi, et al. 2010)
Vinyl flooring	6.7 ($\mu g \cdot h^{-1} \cdot m^{-2}$) after 48h	USA	(USEPA 1999)

Table 6. Ethylbenzene emission rates from building materials and various consumer products

Source	Emission rate	Country	Reference
Glued carpet	4.62 ± 2.34 ($\mu g \cdot h^{-1} \cdot m^{-2}$)	USA	(Wallace, et al. 1987)
Mosquito repellent /coil	2300 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Mosquito repellent /liquid vaporiser	90 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Mosquito repellent /mat	50 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Tobacco smoke	101 ($\mu g \cdot cig^{-1}$) (from 6 commercial brands in USA)	USA	(Hodgson, et al. 1996)
Carpets	<3 ($\mu g \cdot h^{-1} \cdot m^{-2}$) after 48h	USA	(USEPA 1999)

Table 7. M, p-Xylene emission rates from building materials and various consumer products

Source	Emission rate	Country	Reference
Glued carpet	9 ± 1,44 ($\mu g \cdot h^{-1} \cdot m^{-2}$)	USA	(Wallace, et al. 1987)
Glued wallpaper	1,56 ± 0,39 ($\mu g \cdot h^{-1} \cdot m^{-2}$)	USA	(Wallace, et al. 1987)
Mosquito repellent /coil	1700 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Mosquito repellent /liquid vaporiser	450 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Mosquito repellent /mat	160 ($\mu g \cdot h^{-1}$)	Korea	(Jo and Lee 2009)
Tobacco smoke	300 ($\mu g \cdot cig^{-1}$) (from 6 commercial brands in USA)	USA	(Hodgson, et al. 1996)

Wallpaper/adhesive assembly	0.11 ($\mu g \cdot h^{-1} \cdot m^{-2}$) after 250 h	Korea	(Choi, et al. 2010)
Plywood flooring/ adhesive assembly	0.31 ($\mu g \cdot h^{-1} \cdot m^{-2}$) after 227 h	Korea	(Choi, et al. 2010)
New carpets	<3 ($\mu g \cdot h^{-1} \cdot m^{-2}$) after 48h	USA	(USEPA 1999)
Vinyl flooring	5.3 ($\mu g \cdot h^{-1} \cdot m^{-2}$) after 48h	USA	(USEPA 1999)

Table 8. o-Xylene emission rates from building materials and various consumer products

Source	Emission rate	Country	Reference
Glued carpet	5.88 ± 1.56 ($\mu g \cdot h^{-1} \cdot m^{-2}$)	USA	(Wallace, et al. 1987)
Glued wallpaper	0.39 ± 0.186 ($\mu g \cdot h^{-1} \cdot m^{-2}$)	USA	(Wallace, et al. 1987)
Tobacco smoke	67 ($\mu g \cdot cig^{-1}$) (from 6 commercial brands in USA)	USA	(Hodgson, et al. 1996)
New carpets	<3 ($\mu g \cdot h^{-1} \cdot m^{-2}$) after 48h	USA	(USEPA 1999)
Vinyl flooring	6.3 ($\mu g \cdot h^{-1} \cdot m^{-2}$) after 48h	USA	(USEPA 1999)

As detailed in the next chapter (Step 3: Emission-indoor air modeling) emission data was not used to derive indoor concentration through an IAQ model. The reason for this was that at the time of performance of the study, no reliable data were available at the European scale. On the contrary, measurements of indoor concentrations of BTEX were available and quality controlled through a series of peer reviews. Thus, we decided to base the BTEX case study on these measurements instead of the as yet unreliable release data. The above data are listed for informative purposes. They will be used in future revisits of the case study to complete the full chain assessment with European release/emissions data and intercompare them with the non-European datasets provided above.

Step 2a: Overview of the concentration of BTEX data in UE residential settings

Concentration data

BTEX is currently monitored in many cities and industrial areas in EU. In addition many literature works focused on indoor air concentration measurements so that the amount of data available regarding the concentrations levels of all the four VOC’s could be considered enough to have a comprehensive picture of the current levels in EU.

The range of measured concentrations of different VOCs in indoor air is extremely wide, often two or more orders of magnitude. Also, the range of concentrations for specific VOCs can vary widely between measurements.

There are a lot of information sources about VOC’s indoor concentration as this mixture and its components are widely studied in literature. A comprehensive review paper on VOC’s concentration in indoor locations (Sarigiannis, et al. 2011) has been used to collect typical indoor concentrations for selected cities and locations type. This paper covered studies published within the last twenty years

(1990-2008) and focused on various indoor environments, including flats, residences, public buildings, cars etc. In this report, the review is extended until the year 2011.

Benzene

Benzene is detected in almost all indoor environments. The only cases where benzene was not detected were in Finland in two newly built apartments. The highest benzene concentration (404.4 μg/m^3) reported by Zabiegala et al. (1999), who investigated the levels of VOCs concentration in newly constructed and renovated buildings in Gdansk region in Poland. The authors reported a mean value of benzene concentration of 81.6 μg/m^3. Results from other studies indicate that in most homes mean concentrations are typically lower than 10μg/m^3 (or around 10μg/m^3; i.e., 10.1 μg/m^3, 10.6 μg/m^3 and 10.9 μg/m^3 in Athens, Düsseldorf and Rouen, France, respectively (Chatzis, et al. 2005; Elke, et al. 1998; Jantunen 1999; Kouniali, et al. 2003). Only five studies in Torino, Milan, Hannover, Birmingham and Germany, reported mean concentrations of 13.4 μg/m^3, 12.5 μg/m^3 - 80.9 μg/m^3, 13.9 μg/m^3, 11.5 μg/m^3 -16.3 μg/m^3 and 22 μg/m^3 respectively (Eberlein-König, et al. 2002; Ilgen, et al. 2001; Jantunen 1999; Kim, et al. 2001; Tumbiolo, et al. 2005). In studies conducted in public buildings, the highest benzene concentration reported in Europe (109 μg/m^3) was recorded in the study by Zuraimi et al. (2006), which is a comparative study on the indoor air VOCs concentration between public offices in Europe and in Singapore, based on campaigns conducted by the authors. The mean concentration of benzene in all European buildings studied was 14.6 μg/m^3, while for Singapore mean value was 87.1 μg/m^3, i.e. significantly higher than in Europe. Based on the outcomes of other similar studies, it is concluded that high benzene concentrations were observed in public buildings; i.e., in a library in Italy the mean value was 39 μg/m^3 (Righi, et al. 2002); in Thessaloniki (Greece) a mean value of 33 μg/m^3 is reported (Kotzias, et al. 2009). Relatively low benzene concentrations ranging from 0.7 μg/m^3 – 10.5 μg/m^3 are reported from studies in schools and day care centers, and only in a day care center in Rouen, France (Kouniali, et al. 2003), concentration exceeds 35 μg/m^3. Increased concentrations of benzene (44 μg/m^3) were observed inside the Athens Olympic Sports Complex—Indoor Sports Hall (AOSC), the facilities that hosted the indoor sports during the Athens Olympic Games in 2004. High benzene concentrations were measured in pubs and restaurants in UK (31.7 μg/m^3 and 22.7 μg/m^3), in Madrid (19.4 μg/m^3) and Bucharest (17.7 μg/m^3) (Field 2005; Virtanen, et al. 2007). Esteeve-Turillas et al (2009) reported concentrations from car parks and diesel tank rooms ranging from 9 μg/m^3 to 1200 μg/m^3. Concentration of benzene in cars from three studies in UK, Germany and Spain range from 3 μg/m^3 to 203.7 μg/m^3 (Elke, et al. 1998; Esteve-Turrillas, et al. 2007; Virtanen, et al. 2007).

On the one hand, concentrations of benzene (and other VOCs) are slightly higher in southern Europe, attributed to the higher temperatures that lead to higher volatilization. On the other hand, during spring and summer, the more frequent opening of windows in southern Europe results in higher AERs and therefore a decrease in VOCs indoor concentration. The type of ventilation may also differ, e.g. in northern Europe, mechanical ventilation is common, whereas in southern parts of Europe natural ventilation is used. The air flow rates may differ significantly among the different ventilation types resulting in consequent differences in concentration levels. The net result of these contrasting drivers is significant variability both within and among the different countries in Europe.

The collected indoor concentration levels of benzene are given in Table 12 in Appendix 1.

Toluene

Toluene is almost always present in indoor air in detectable concentrations, which range from a few μg/m^3 to 1117 μg/m^3. It is worth noticing that the highest values was observed in diesel tank rooms (1117 μg/m^3) and car parks (830 μg/m^3) in UK (Eberlein-König, et al. 2002). In residences or houses, the typical concentrations of toluene ranged from 4-5 μg/m^3 to 30 μg/m^3, although higher concentrations have been registered, as well; i.e., 54 μg/m^3 in Erfurt (Schneider, et al. 1999), 84.9 μg/m^3 in Torino (Tumbiolo, et al. 2005), 86.2 and 77.6 μg/m^3 in Prague and Milan, respectively (Hanninen, et al. 2002), 148.8 μg/m^3 in Gdansk (Zabiegala, et al. 1999) and 318 μg/m^3 in Hannover (Ilgen, et al. 2001). In a naturally ventilated sports centre in Athens (Stathopoulou, et al. 2008) at the spectator seats, the toluene concentration was 84 μg/m^3 for the whole sampling period. During the sports "event" days, however, the toluene concentration was even higher, reaching 95 μg/m^3. Given the prevalent wind direction in the area and the ventilation system of the stadium, the relatively high concentrations of toluene could be attributed to outdoor sources, and more specifically, to the heavy traffic of the surrounding roads. Concentrations in bars and restaurants range from 1.3 μg/m^3 in Helsinki (Vainiotalo, et al. 2008) to 57 μg/m^3 in Birmingham (Virtanen, et al. 2007). Relatively low values of toluene concentration (below 5 μg/m^3) have been observed in schools and day care centers (Roda, et al. 2011; Stranger, et al. 2007). In public buildings, mean concentrations are typical lower that 20 μg/m^3. However, higher values have been reported; i.e., offices in Birmingham (22 μg/m^3), Athens (90.2 μg/m^3) and EU (35.1 μg/m^3), a library in Modena, Italy (46 μg/m^3) and a museum in Athens (42.9 μg/m^3) (Righi, et al. 2002; Saraga, et al. 2011; Virtanen, et al. 2007; Zuraimi, et al. 2006). The concentration detected in cars, buses and trains range from 11.8 μg/m^3 in a train in Torino (Tumbiolo, et al. 2005) to 494 μg/m^3 in a car in Birmingham (Virtanen, et al. 2007).

The collected indoor concentration levels of toluene are given in Table 13 in Appendix 1.

Ethylbenzene

Ethylbenzene in indoor environments is released by the use of consumer products such as pesticides, liquid process photocopiers and plotters, solvents, carpet glue, paints, varnishes, automotive products, adhesives, and fabric and leather treatments (ATSDR 1999). Studies have identified that in a home using gasoline-contaminated drinking water, exposures to ethylbenzene could occur via inhalation during showering and other household activities (Beavers, et al. 1996). Ethylbenzene concentrations in shower air were often one to two orders of magnitude higher than non-shower air (ATSDR 1999).

Concentrations of ethylbenzene usually follow the trends of the other aromatics, usually ranging between 0.9 to 3 μg/m^3. Among the reported studies, the latest one based on a large number of samples (350) carried out by Esplugues et al. (2010) in Valencia identified an average concentration of 2.3 μg/m^3. Elevated concentrations of ethylbenzene were identified in newly finished offices, where concentrations up to 332 μg/m^3 were measured in Gensk (Zabiegala, et al. 1999).

Locations where ethylbenzene might deviate from the usual levels are car parking (Esteve-Turrillas, et al. 2009) and chemical laboratories (Elke, et al. 1998). On the contrary, the variation in the concentrations between smoking and non-smoking areas was small, as identified by the study of Vainiotalo et al (2008), indicating that environmental tobacco smoke (ETS) is not such a strong source of ethylbenzene emissions as it is for other aromatics.

The collected indoor concentration levels of ethylbenzene are given in Table 14 in Appendix 1.

Xylenes

Xylenes are widely used in the chemical industry as solvents for products such as paints, inks, dyes, adhesives, pharmaceuticals, and detergents. Xylenes are also emitted in the indoor environment as a result of cigarette smoking (Kotzias, et al. 2004)[1]. Xylenes are usually reported in literature together

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[1]A lot of organic contaminants are emitted by smoking indoors; overall, the presence of ETS is a dominant source, followed by outdoor air penetration and use of cleaning products and disinfectants.

with benzene and toluene. Xylene concentration is reported in three different ways: (a) as three individual isomers (m-, o-, and p-xylene) separately; (b) as the sum of all three xylene isomers without any information on the most abundant; and (c) o-xylene on its own and (m- and p-) xylenes together, because of their close gas chromatographic retention times and insufficient separation.

The concentrations of xylene reported in the literature are given in Table 4. Individual xylenes mean indoor concentrations usually range between not-detected (ND) and 10 μg/m^3. Nevertheless, higher concentrations have also been reported; i.e., in homes in Helsinki (72 μg/m^3) and Gdansk (438.9 μg/m^3) (Järnström, et al. 2006; Zabiegala, et al. 1999). The maximum observed concentration is concerned was 241 μg/m^3 for the sum of m- plus p- xylenes in office building in Athens (Liu, et al. 2011). m-Xylene concentrations were high in two stadiums in Athens (Stathopoulou, et al. 2008). Results revealed that outdoor pollution significantly affected IAQ of both halls. However, this effect was different for the two buildings, depending on the ventilation types, the wind direction prevailing and the kind of indoor activity recorded. In the Peace and Friendship Stadium (PFS) in Athens at the spectator seats, m-xylene concentration was 57 μg/m^3 for the whole experimental period. During the sports "event" days, however, m-xylene was only slightly increased (61 μg/m^3). It is worth noticing that concentration in xylenes deviate from the usual levels at car parks and diesel tank rooms (Esteve-Turrillas, et al. 2009).

The collected indoor concentration levels of xylenes are given in Table 15 in Appendix 1.

Step 3: Emission-indoor air modeling

Exploiting the flexibility of the INTERA source to dose methodological approach we decided to follow the full chain starting from the indoor concentration data for the BTEX case study.

Two main and complementary reasons are behind this choice: data on BTEX emission from consumer product and other indoor emission sources lacked not allowing therefore the creation of reliable emission scenarios. This could lead to a substantial underestimation of the true indoor concentration levels and consequently of both the external and internal exposure associated.

On the other hand the extensive review carried out in the project on BTEX concentration levels in residential settings showed a wide data availability in many different European Countries and in several types of indoor settings. This allowed us to work with more detailed estimates of the exposure levels and to better address the geographical differentiation in the exposure levels, which is one of the main objectives of the INTERA case studies. In addition the use of concentration levels allowed to reduce the uncertainty associated with the use of the IAQ model mainly due to uncertain emission data and finally to provide more reliable estimates of the exposure levels associated.

Step 4: Exposure modeling

Exposure modeling

Personal exposure is equal to the average concentration of a pollutant that a person is exposed to over a given period of time, e.g. 1 day, 1 month or 1 year. If over the given period of time, ***T***, the person passes through n locations, spending a fraction $\boldsymbol{f_n}$ of the period ***T*** in location ***n*** where the concentration of the pollutant under consideration is $\boldsymbol{C_n}$, then the personal exposure for this period ***T***, represented by the concentration $\boldsymbol{E_T}$, is given by (Ott 1982):

$$E_T = \sum_n f_n \cdot C_n \cdot inh_n$$

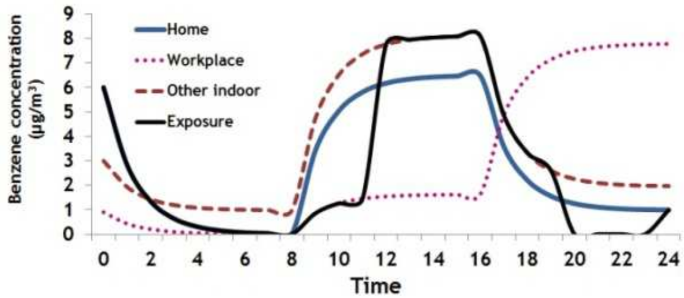


Figure 2. Diurnal variation of indoor locations concentrations encountered by a single individual and the corresponding exposure

where $\boldsymbol{inh_n}$ is the inhalation correction coefficient for each type of microenvironment ***n*** encountered in the calculations.

In accordance, ***uptake*** is defined as the integral in time of exposure ***E*** and inhalation rate ***inh*** divided by the bodyweight ***BW*** for the relevant time frame (usually one day).

$$Uptake = \frac{\sum_n E_n \cdot inh_n}{BW}$$

For as much as possible accurate exposure estimations, information from TMADs (Time Micro-environment Activity Diaries) has to be evaluated in order to assess the diurnal variation of exposure (as shown in Figure 2). Adequate data on TMADs regarding the EU exist from the EXPOLIS study (Edwards, et al. 2006; Lai, et al. 2007; Lai, et al. 2004; Schweizer, et al. 2007), are already implemented in the KMS and they will be used for the needs of the assessment. Indicative data for selective countries are presented in Table 9. The complete list of data used for characterizing the Time Micro-environment Activity Diaries are reported in Appendix 2. Data on inhalation rates and bodyweight disaggregated by gender, age classes and geographical location are reported Appendix 3.

In order to expand exposure assessment from the single individual to the wider population groups, probabilistic modeling techniques have been implemented (Bogen, et al. 2009; Mutshinda, et al. 2008; Zidek, et al. 2005). In this case the exposure determinants will constitute the prior distributions and they will be implemented in a Monte-Carlo model, from where the population exposure distributions will be derived.

Table 9. Indicative data for selective countries TAMD (hours/day)

		Outdoor	Home	Work	Other

					indoor
Finland	**Mean**	3.0	13.8	5.9	1.2
	Max	14.0	24.0	12.3	11.1
	Min	0.0	3.8	0.0	0.0
	STD	2.0	3.0	3.1	1.5
Greece	**Mean**	3.3	15.3	4.1	1.3
	Max	12.6	24.0	15.0	7.8
	Min	0.0	2.4	0.0	0.0
	STD	2.1	4.3	3.6	1.5
Switzerland	**Mean**	3.2	13.5	5.6	1.7
	Max	13.7	22.5	14.3	10.6
	Min	0.3	0.9	0.0	0.0
	STD	2.0	3.4	3.5	1.6
France	**Mean**	2.6	14.5	5.3	1.7
	Max	24.0	23.6	17.4	16.9
	Min	0.0	0.0	0.0	0.0
	STD	2.6	4.4	3.7	2.7
Italy	**Mean**	2.7	13.5	6.3	1.4
	Max	11.4	22.5	12.2	10.6
	Min	0.0	8.1	0.0	0.0
	STD	1.7	2.6	3.0	1.3
Czech	**Mean**	3.1	14.1	5.6	1.2
	Max	12.1	23.5	10.4	8.7
	Min	0.5	7.6	0.0	0.0
	STD	2.2	3.6	3.4	1.7
UK	**Mean**	2.8	16.0	4.3	0.9
	Max	9.4	23.0	13.9	6.3
	Min	0.4	4.3	0.0	0.0
	STD	1.8	3.3	3.5	1.2

Step 5: Internal dose modeling

A PBPK/PD model for BTEX has been already developed and validated against experimental data (Sarigiannis and Gotti 2008).

Benzene, toluene, ethylbenzene, and xylene are volatile mono-aromatic hydrocarbons commonly found together in gasoline and are common VOC components of outdoor and indoor air mixtures due to their widespread use in many commercial products. As a result, these aromatic compounds co-exist in the majority of environmental settings (occupational and residential). Because these aromatics compete with benzene for cytochrome P450 isozyme (CYP2E1), these co-exposures might potentially reduce the overall metabolism of benzene. Thus, the quantification of this interaction to the overall internal dose is of great interest.

To quantify this interaction, a PBPK/PD model for a quaternary mixture of BTEX was developed (Sarigiannis and Gotti 2008) based on the approach of Krishnan et al. (2002). This approach considers that the interaction between two or more chemicals causes a modification of the rate of metabolism of each chemical due to the presence of the other chemicals that compete for the binding sites resulting in a mutual inhibition of metabolism. The PBPK/PD model for a generic mixture of chemicals is represented as a combination of "single chemical" models interconnected at level of hepatic metabolism where the effect of the interaction is evaluated according to the potential mechanism of action (competitive, non-competitive, and uncompetitive metabolic inhibitions). The latter, in the case of a BTEX mixture, is assumed to be of "competitive inhibition" since the four VOC's considered are known substrates for CYP2E1. This is further confirmed by the analysis of the kinetic data from all binary exposure studies relevant to the BTEX mixture (Haddad, et al. 1999).

The overall conceptual representation of the PBPK/PD model for a mixture of BTEX is shown in Figure 3. The models used for toluene, ethylbenzene and all the family of xylenes are all four-compartment models similar to that of Tardif et al. (1997) and of Haddad et al. (1999) encompassing richly perfused tissues (RPT), poorly perfused tissues (PPT), adipose tissues (FAT), and liver (metabolizing tissue), interconnected by systemic circulation and a gas exchange lung.

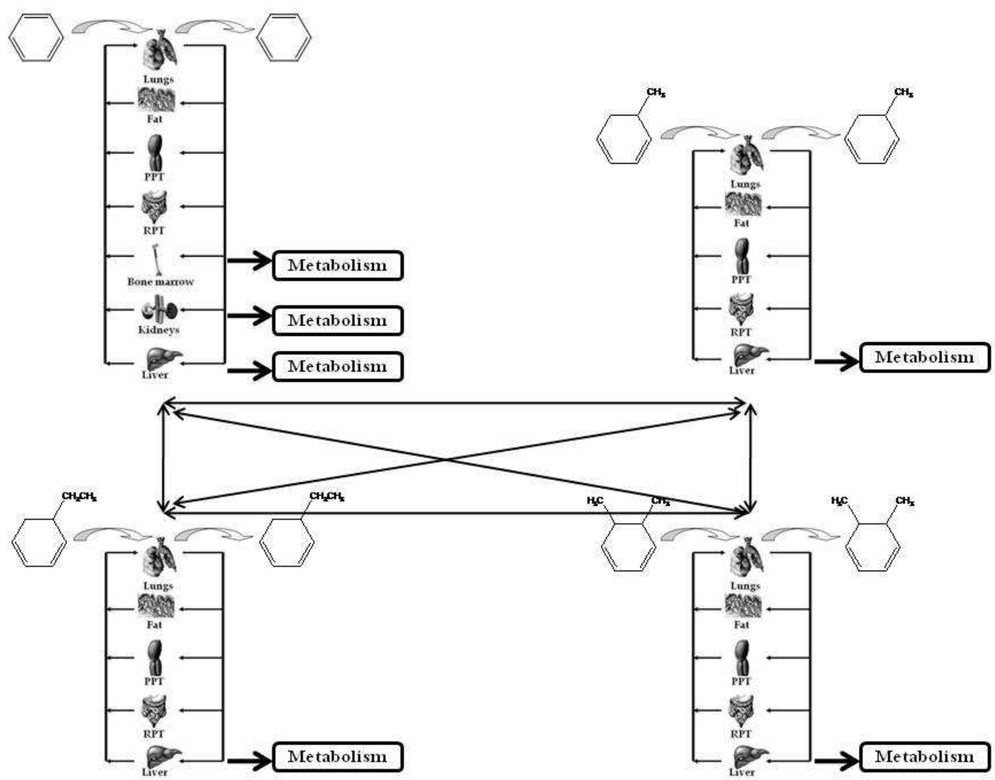


Figure 3. Conceptual representation of the PBPK/PD model for a mixture of BTEX

The model for benzene is a six-compartment model that is an extension of that of Medinsky et al. (1989) and of Travis, et al. (1990) adding the kidney as a further site of metabolism. The six tissue groups utilized in the model include the liver (main metabolic tissue); adipose tissue (FAT); richly perfused tissues (RTP); poorly perfused tissues (PPT); bone marrow (the main target organ for benzene toxicity) and the kidney; each one interconnected to the others by systemic circulation and a gas-exchange lung. The bone marrow was included because it is recognized as the main site where benzene toxicity (i.e. leukemia) is manifested and because it is, together with the kidney, a potential site for benzene metabolism.

As the toxicity of benzene is main related to its metabolites, due to the high potential toxicity of benzene metabolites associated to the leukemia risk in humans, the model takes into account the metabolic chain of benzene to its key metabolites The whole metabolic chain of benzene was modeled through the PBPK model schematically presented in Figure 4 to evaluate tissue levels of benzene, benzene oxide (BO), phenol (PH), and hydroquinone (HQ), as well as the total amounts of muconic acid (MA), phenylmercapturic acid (PMA), phenol conjugates, hydroquinone conjugates, and total catechol produced.

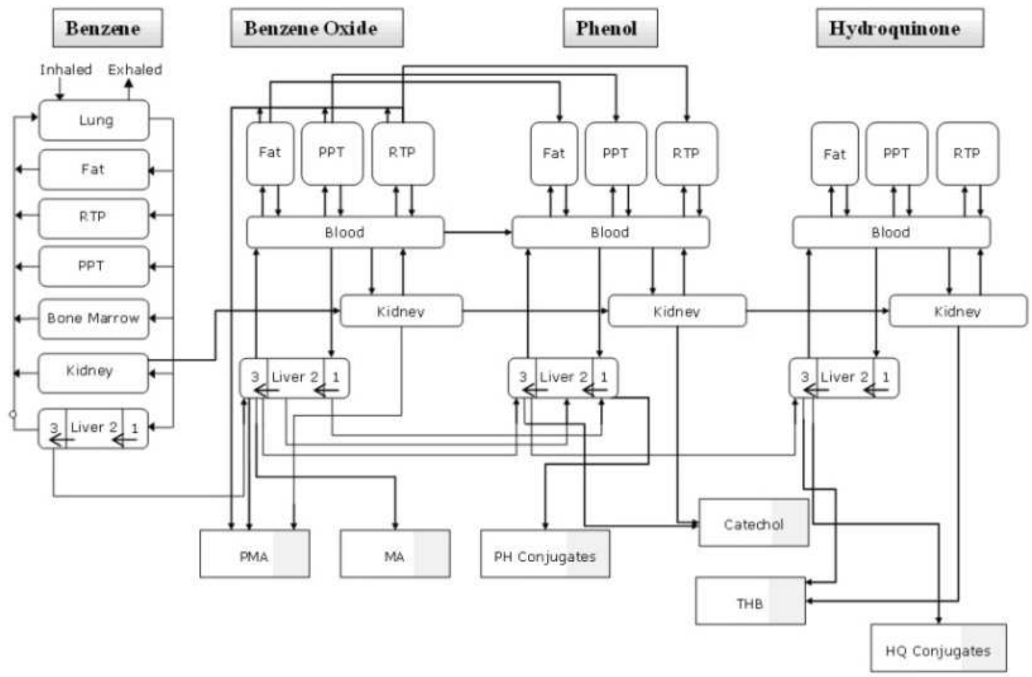


Figure 4. Conceptual representation of benzene PBPK model (Sarigiannis and Gotti, 2008)

The metabolic inhibition effect grows with the number of substances constituting the mixture: when humans are exposed to all four chemicals together, interaction effects on benzene are even greater than in the ternary or the binary mixtures. Ethylbenzene, for example, further increases the unchanged concentrations of benzene not only because ethylbenzene interferes directly with the metabolism of benzene but also because it inhibits toluene and xylenes metabolism, increases their unchanged concentrations, and thus enhances their inhibitory effect on benzene. The interaction effect due to concurrent exposure to a chemical mixture can be better appreciated when the exposure levels are higher with respect to typical environmental exposures.

Biomonitoring data

Human biomonitoring (HBM) is rapidly becoming a generalized approach to estimating the internal dose of xenobiotics in humans as exemplified by large-scale exercises such as the NHANES and NCS studies in the USA and the COPHES/DEMOCOPHES initiatives in the EU. In the implementation of the INTERA methodology, HBM data are used to validate the internal dose estimates of the PBPK model developed for each individual component of the BTEX mixture and for co-exposure to the quaternary mixture as a whole.

Benzene

The main biological markers of exposure to benzene are products of benzene metabolism or unmetabolized benzene excreted in urine. Benzene metabolism begins in the liver where several enzymes convert it into a number of metabolites including phenol, hydroquinone (HQ), catechol, s-phenylmercapturic acid (s-PMA) (Tranfo, et al. 2010), and trans, transmuconic acid (tt-MA). Both s-PMA and tt-MA are excreted in the urine, and as such they are commonly used as biomarkers of exposure (Weisel, et al. 1996). Phenol has been found to characterise levels of exposure between 1 ppm and 190 ppm (Weisel, et al. 1996). Urinary tt-MA and s-PMA (Paci, et al. 2007) have been considered suitable biomarkers for exposures in the range of 0.1–1ppm (Weisel, et al. 1996).

tt-MA is excreted in urine (3-18% of total absorbed dose) after the formation of the toxic intermediate t,t-muconaldehyde. However t,t-MA lacks specificity and reliability at low exposure levels (Barbieri, et al. 2002). In particular, it is also produced from metabolism of sorbic acid that may be present in food; daily ingestion of sorbic acid significantly increases the biological background concentration of t,t-MA, therefore its specificity as marker for benzene is limited.

S-phenylmercapturic acid (SPMA) is derived from very low levels of metabolism from electrophilic intermediates reacting with endogenous glutathione (detoxification pathway, <1%). Contrary to tt-MA, SPMA shows high specificity but is poorly excreted in urine (Barbieri, et al. 2002). These biomarkers rarely show good correlation with environmental exposure at ppb levels (Sabatini, et al. 2008). Therefore, the value of either of these urinary biomarkers to detect low, environmentally-relevant levels of exposure via the environment is questionable (Manini, et al. 2006).

Both metabolites have relatively long half-lives (5 h for t,t-MA and 9 h for SPMA). This may influence strongly biomonitoring results with regard to inferring actual exposure to benzene depending on monitoring time (for instance, significant differences can be observed if the monitoring occurs at the end of the work-shift or during the workweek) (Qu, et al. 2000). For these reasons, unmetabolized benzene excreted in urine (UBz) has been recently investigated as a specific and reliable biomarker at very low levels of exposure (< 0.002 ppm) (Fustinoni, et al. 2005; Fustinoni, et al. 2005). The powerful analytical methods developed in the last few years allow the quantitative determination of very low concentrations of benzene in urine. Although the use of UBz as an accurate benzene exposure marker has not been fully validated, several works have shown a better correlation between UBz and airborne benzene as compared to other biomarkers (Fustinoni, et al. 2005; Fustinoni, et al. 2005; Waidyanatha, et al. 2001).

Benzene biomonitorig data were user to validate the PBPK model. Validation of the benzene “section” of the PBPK model was accomplished through a comparison with the experimental data of the work of Pekari et al. (1992). They exposed three healthy volunteers to benzene vapor at 10 ppm and 1.7 ppm for 4 hours collecting, at certain time during and after the exposure, the benzene concentration in venous blood and expired air. The comparison between the PBPK/PD model results and the experimental data are shown in **Error! Reference source not found.**. Each experimental data point represents the mean of the three adult male volunteers.

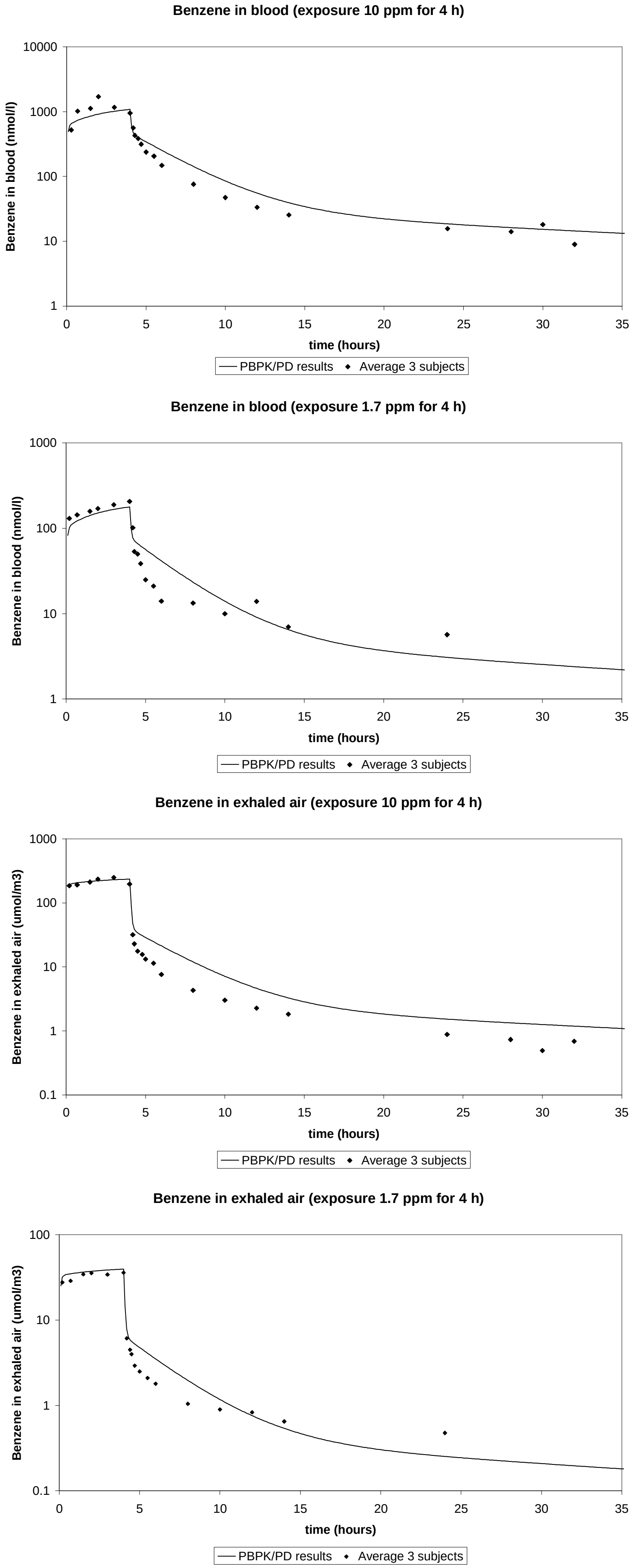


Figure 5. Comparison of the PBPK/PD model results relevant to blood and expired air concentration of benzene, with corresponding experimental data (diamond) obtained as average of three male volunteers during and after 4 h of exposure to a benzene concentration of 10 ppm and 1.7 ppm.

Results show that the developed model provides good estimations of the benzene kinetic within the human body reproducing correctly the dynamic of benzene both in the venous blood and in the exhaled air.

A further validation step regarded the whole modelled metabolic chain of benzene. The model results were validated through a comparison with two independent datasets derived from literature.

In the work of Kim et al. (2006), the authors investigated the major urinary metabolites (phenol [PH], muconic acid [MA], hydroquinone [HQ] and catechol [CAT]) as well as the minor metabolite, S-phenylmercapturic acid [S-PMA], in 250 benzene-exposed workers in Tianjin, China. Full-shift exposures to benzene were monitored with passive samplers and urine was collected from each participant at the end of each working shift for which air had been monitored. In terms of exposure the median value of benzene exposure during the work-shift was equal to 1.18 ppm.

Waidyanatha et al. (2004) collected urinary concentration data for the same keys metabolites of benzene in 44 benzene-exposed workers selected from three factories in Shanghai where benzene was used in the production chain. Spot urine samples were collected at the end of work-shift.

Individual exposures were monitored using passive personal monitors worn by each worker for a full work-shift on 5 consecutive workdays during the 1- to 2-week period prior to urine collection. The subjects were subdivided into two different groups according to the exposure levels: the “lower exposure” group showed a median value of 13.6 ppm while the “higher exposure” group a median of 92.0 ppm during the working hours.

The results of both the comparisons in term of concentration of each single metabolite in urine are summarized in

Table 10.

The data given refer to occupational exposure to benzene; at the time of performing the study we were not aware of HBM data referring to residential exposure. Nevertheless, the range of urinary benzene metabolite values given in the table above cover a large enough range of values under controlled exposure conditions. Thus, the HBM data given above are considered as appropriate for a full-blown validation of the PBPK/PD model for benzene.

Table 10: comparison between experimental urinary concentration (mg/L) of main benzene metabolites and PBPK/PD predictions:

Benzene exposure: 92 ppm	**Metabolite**	**Urinary concentration* Median [min – max]**	**Urinary concentration from PBPK/PD model**
	PH	196 [27.1 - 374]	342.5
	CAT	40.3 [3.79 - 85.1]	71.9
	HQ	22.1 [3.3 - 50.6]	11.5
	S-PMA	7.69 [0.123 - 27.5]	6.2
	MA	41.2 [7.25 - 133]	32.6
Benzene exposure: 13.6 ppm	**Metabolite**	**Urinary concentration* Median [min – max]**	**Urinary concentration from PBPK/PD model**
	PH	18.2 [3.87 - 175]	86.2
	CAT	3.09 [0.673 - 23.8]	30.4
	HQ	3.97 [0.524 - 36.2]	4.5
	S-PMA	0.175 [0.050 - 5.89]	1.6
	MA	7.14 [1.14 - 77.8]	8.8
Benzene exposure: 1.18 ppm	**Metabolite**	**Urinary concentration** Median [min – max]**	**Urinary concentration from PBPK/PD model**
	PH	14.9 [1.5 - 389.6]	85.3
	CAT	2.3 [0.4 - 48.2]	27.4
	HQ	1.9 [0.3 - 47.0]	4.0
	S-PMA	0.06 [0.00036 - 7.04]	0.6
	MA	1.7 [0.1 - 60.5]	5.8

* Data from Waidyanatha et al. (2004).

** Data from Kim et al. (2006)

Results shows that the urinary concentrations of the main benzene metabolites are within the range of variability showed by the experimental studies confirming the correctness and the accuracy of the model developed

Toluene

The biological exposure indices recommended by ACGIH (1999) to assess exposure of workers to toluene in the workplace are ortho-cresol and hippuric acid levels in urine at the end of a workshift and toluene levels in blood immediately prior to the last shift of a workweek. However, there are no markers of toluene exposure that persist in the body for an extended period of time after exposure has ceased. Although measurement of urinary excretion of toluene metabolites (hippuric acid, mercapturic acids, ortho-cresol and para-cresol) is a less invasive method than blood sampling for determining toluene exposure, the presence of these compounds in the urine is not definitive proof of toluene exposure since they are also produced by metabolism from the normal diet (Maestri, et al. 1997). It has also been reported that the presence of toluene in urine is a more sensitive biomarker for toluene exposure than the presence of hippuric acid or ortho-cresol (Kawai, et al. 1996). In addition, the background levels of these metabolites may be affected by individual variability (Lof, et al. 1993) ethnic differences (Inoue, et al. 1986), or other factors such as alcohol consumption and smoking (Maestri, et al. 1997). Despite these limitations, according to the extensive review carried out by

USEPA (2000), a significant number of authors have shown a correlation between the levels of these metabolites in urine and toluene exposure and they have been widely used as biomarkers of toluene exposure.

Ethylbenzene

According to the review of USEPA (1999), exposure to ethylbenzene can be determined by the detection of mandelic acid and phenylglyoxylic acid in urine or by direct detection of ethylbenzene in whole human blood. Numerous studies indicate that environmental exposures to ethylbenzene can result in detectable levels in human tissues (Antoine, et al. 1986) and in expired air (Wallace, et al. 1985). Analysis of blood specimens from a test population of 250 patients (Antoine, et al. 1986) and composite samples obtained from blood donations of laboratory personnel with potentially low-level exposure (Cramer, et al. 1988) indicated ethylbenzene concentrations in the blood to range from below detection limits to 59 ppb. Studies examining the correlation of ethylbenzene concentrations in ambient air with concentrations measured in expired or alveolar air have also been conducted (Wallace, et al. 1985). Ethylbenzene concentrations in breath samples were reported to correlate well with ethylbenzene concentrations in indoor samples taken with personal air monitors (Wallace, et al. 1985).

Xylenes

Xylene levels in the blood and levels of its metabolite, methylhippuric acid, in the urine are the primary markers used to detect exposure to xylene (USEPA 2007). Measurement of blood levels of xylene is limited by the rapid metabolism of xylene. Moreover, there are no data on background concentrations of xylene in blood or urine. Xylene and xylene isomers have been detected at concentrations of up to 400 nM in urine of workers exposed to xylene at geometric mean concentration of 1.9 ppm with a maximum concentration of 27.3 ppm (Takeuchi, et al. 2002). Xylenes are metabolized almost exclusively to methylhippuric acids in humans. Detection of methylhippuric acid in the urine is the most widely used indicator of xylene exposure (USEPA 2007). A strong association has been shown between urinary methylhippuric acid concentrations and exposure to xylene (Daniell, et al. 1992); The excretion of methylhippuric acid is complete within 1 or 2 days of exposure to xylene, limiting the utility of this biomarker to the detection of only very recent exposures. With chronic exposure to xylene, the metabolism is enhanced, further limiting the time following exposure that xylene levels may be measured in the blood (USEPA 2007). Since the methylhippuric acid background levels in persons not exposed to xylenes are very low, methylhippuric acids are specific markers for xylenes, except for exposure to alkyl toluenes in which the number of carbon atoms in the alkyl group is odd.

Mixture

The study of the effect of the interaction between the chemicals composing a TEX mixture has been the subject of the work of Tardif et al. (1997). They exposed four human volunteers to a ternary mixture of alkyl benzenes (toluene, ethylbenzene and m-xylene) for 7 hours to 17, 33, and 33 ppm, respectively, both alone and in combination. On-time course of blood concentrations regarding the above three VOC's were collected to derive the interaction mechanism as well as to quantify the interaction effect. The data are reported in Table 11.

Table 11: average venous blood concentrations (mg/Liter) of toluene, m-xylene, and ethylbenzene obtained in four humans volunteers exposed for 7 hours to 17, 33, and 33 ppm, respectively, of these solvents alone or in combination.

Time (hours)[1]	Toluene (in mixture)[2] (mg/Liter)	Xylene (in mixture)[2] (mg/Liter)	Ethylbenzene (in mixture)[2] (mg/Liter)	Toluene (alone)[3] (mg/Liter)	Xylene (alone)[4] (mg/Liter)	Ethylbenzene (alone)[5] (mg/Liter)
5.5	0.18	0.50	0.52	0.17	0.40	0.52
6.5	0.18	0.52	0.51	0.18	0.43	0.49
7.5	0.10	0.26	0.25	0.09	0.21	0.25
8	0.06	0.19	0.19	0.06	0.15	0.19

[1] hours after the exposure started

[2] exposure scenario: Toluene 17 ppm; Xylene 33 ppm; Ethylbenzene 33 ppm

[3] exposure scenario: Toluene 17 ppm;

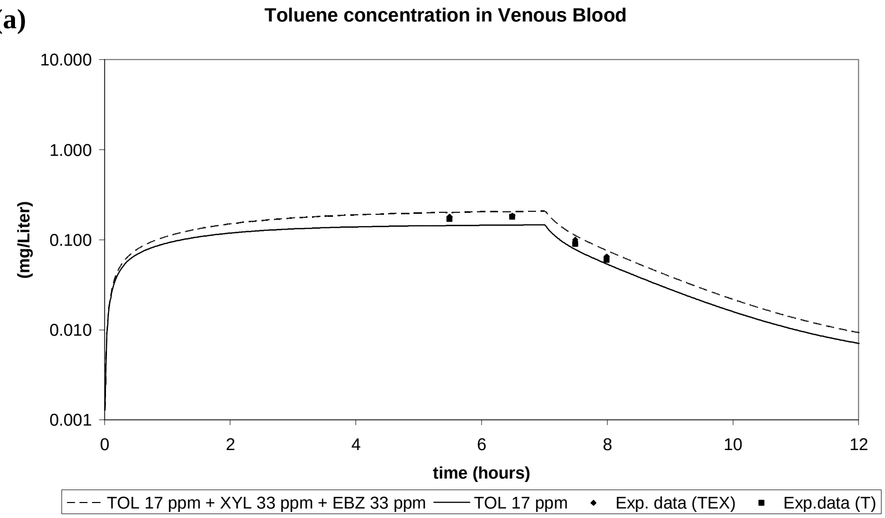
[4] exposure scenario: Xylene 33 ppm;

[5] exposure scenario: Ethylbenzene 33 ppm

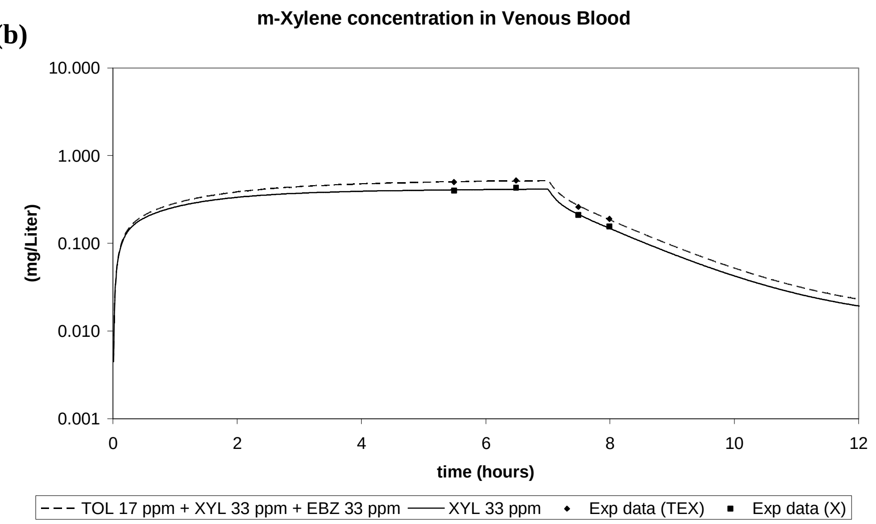
The venous blood as well as the alveolar concentrations resulting from the PBPK/PD simulations were compared with the experimental data obtained exposing humans to the same mixture concentration derived Tardif et al. (1997). Each experimental data point represents the mean for four adult male volunteers. The results of the comparison relevant to venous blood and alveolar concentrations are shown in Figure 7 and in Figure 7.

The results show that the PBPK/PD model developed provides accurate estimation of the kinetics of the TEX mixture in the human body. This confirms that the mechanism of interaction based on the competitive inhibition between the three components of the mixture, all substrates for the same cytochrome P450 isozyme (CYP2E1), describes the experimental data adequately.

(a)



(b)



(c)

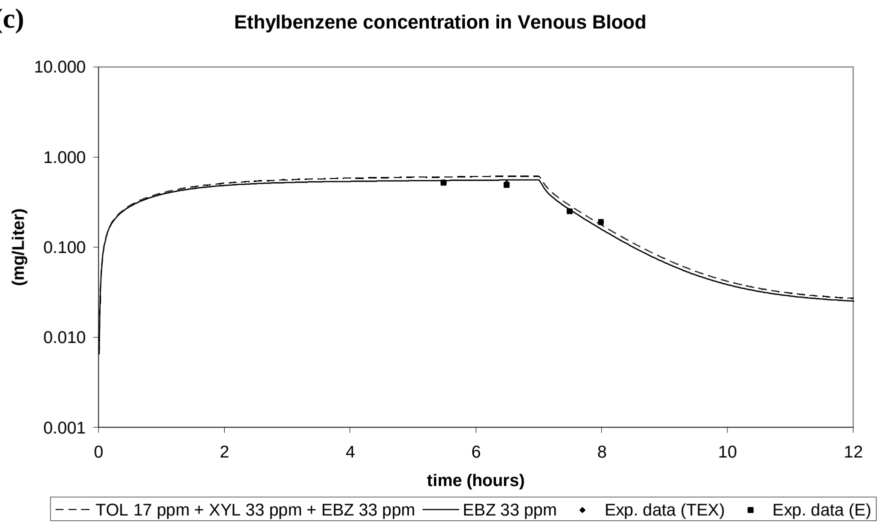
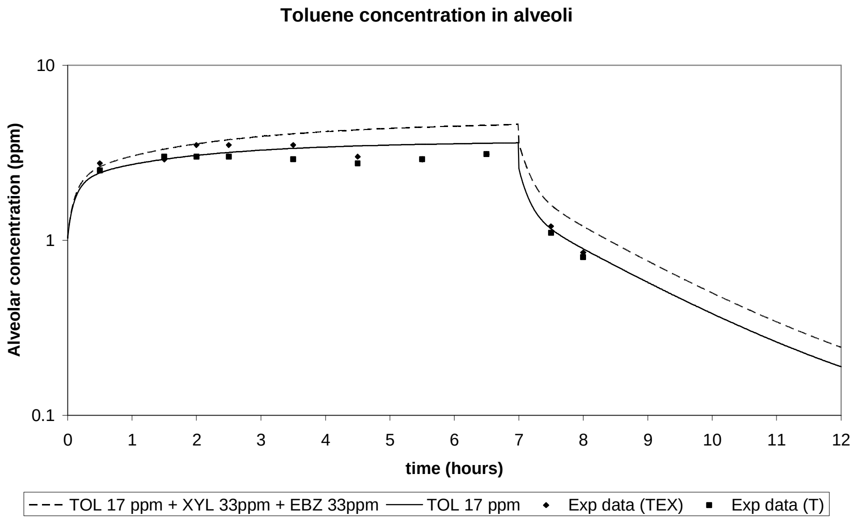


Figure 6. Comparison of the PBPK/PD model results relevant to blood concentration of toluene (a), m-xylene (b) and ethylbenzene (c) predicted by the individual chemical (solid lines) or a ternary chemical PBPK model (dashed lines) with corresponding experimental data (symbols) obtained in

humans exposed for 7 hr to 17, 33, and 33 ppm, respectively, of these solvents alone (square points) or in combination (diamond points).

(a)



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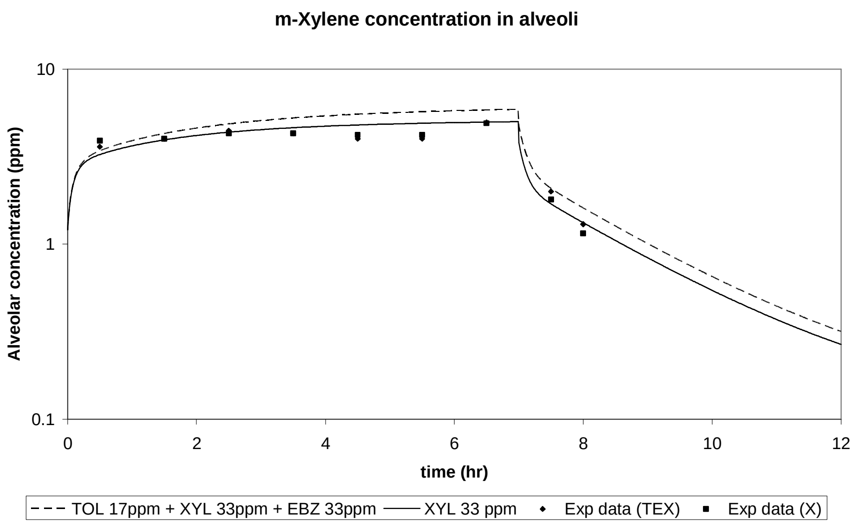


(c)

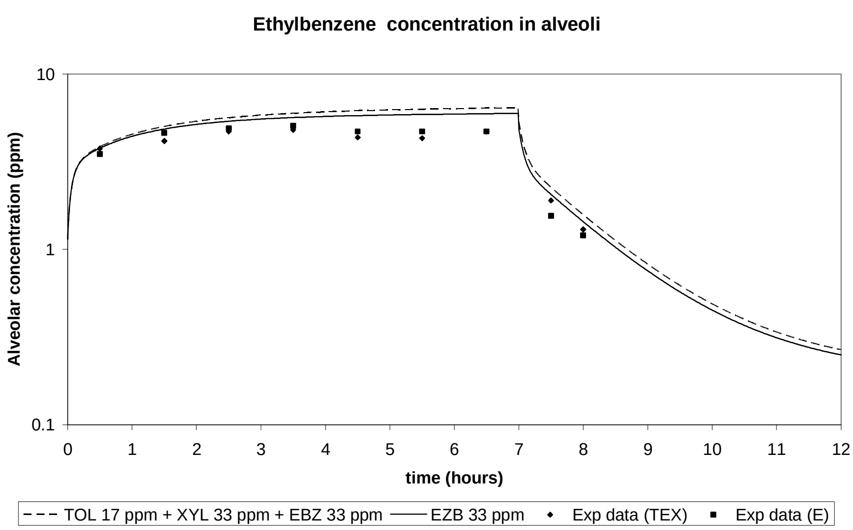


Figure 7. Comparison of the PBPK/PD model results relevant to alveolar concentration of toluene (a), m-xylene (b) and ethylbenzene (c) predicted by the individual chemical (solid lines) or a ternary

chemical PBPK model (dashed lines) with corresponding experimental data (symbols) obtained in humans exposed for 7 hr to 17, 33, and 33 ppm, respectively, of these solvents alone (square points) or in combination (diamond points).

Step 6: Addressing the deficit in the data

Data on indoor sources

The main sources of data deficit has been identified in the data on BTEX emission from consumer products and others indoor sources. Lack of data on this subject has been overcome by information on indoor air concentrations, which after an extensive review showed a wide availability both in terms of geographical differentiations across several countries in the EU and in terms of type of indoor setting.

Geographical coverage

The literature review on BTEX measured concentrations revealed missing data for the indoor and outdoor locations for a number of countries. In their place synthetic data have been used. Surrogate data from other indoor locations are used to approximate concentrations, taking into account the current deviation from the EU concentration. For example, benzene indoor (home) concentration in Poland is 28.8 $\mu g/m^3$, 4.2 times larger than the EU average concentration of 6.8 $\mu g/m^3$. In this respect, starting from the EU average at 6.5 $\mu g/m^3$, concentration in public buildings (e.g. offices) is estimated at 27.1 $\mu g/m^3$.

In addition, although concentration data are reviewed separately for the m,p- xylene and the o-xylene, xylene concentrations are aggregated: mean, max and min concentrations are linearly added and new standard deviations are estimated from the log normal equations.

No others main deficits in the data needed to run the case study were observed.

Step 7: Case study calculations

General considerations

Given the limitations of data availability regarding the emissions of BTEX from consumer products and their use, the calculation of exposure, uptake and internal dose was based starting from micro-environmental concentrations. The respective modeling modules for the individual components of the BTEX mixture have been developed and implemented in the INTERA platform by parameterizing appropriately the generic PBPK model of INTERA. However, no generic PBPK model was developed for mixtures of chemicals in the indoor environment inside the INTERA platform. Thus, we opted to develop a dedicated model for the BTEX mixture outside the platform and use this for estimating the potential interactions among the mixture components when it comes to estimating the internal and biologically effective dose of the BTEX chemicals and their toxic metabolites

The workflow of the calculations is based on:

- Gathering data on micro-environmental concentrations, relevant to the major activities of the population.
- Use of information of time-activity data for estimating exposure diurnal variability and uptake, utilizing the duration and the type of activity, which in turn affects the inhalation rate.
- Estimation of internal dose in terms of benzene within the systemic circulation, as well as the biologically effective dose of benzene toxic metabolites in the bone marrow.

To compute exposure from each population group, a time dependent activity pattern is assumed, including five common locations: home, office, transportation, school, leisure places, outdoor. People on each group are assumed to repeat the same activities during the working days, differentiated in the weekends. Activity patterns are summarized in Appendix 2, Table 16-Table 19.

In addition, each activity is tabulated according to its intensity into four levels: level 1 is assumed to be the lightest (e.g. sleeping) and level 4 the heaviest activity (e.g. sports). The corresponding values of inhalation rates per intensity level and age group are presented in Appendix 2, Table 20. A summary of all activities and their classifications are presented in Appendix 2, Table 21.

From the above data, exposure variability as well as the average weekly uptake was estimated. Exposure was the input to the BTEX PBPK model, thus allowing us to track how exposure variability is translated into internal exposure variability.

Monte Carlo Simulations

A Monte Carlo (MC) analysis is used to investigate uncertainty and variability in exposure, uptake and internal exposure. This analysis can be done using the probabilistic exposure analysis tool of the INTERA platform. Variability was considered for:

- Physiological and biokinetic parameters (Appendix 3), such as the bodyweight differentiated per age group and country (Table 22), the alveolar ventilation rate Q_{ven}, the kinetics of benzene metabolism V_{max} in liver and bone marrow (Table 23).
- Micro-environmental concentrations. Based on the literature review on BTEX concentrations data, distributions were derived when an adequate number of data was able to support a distribution. Table 24 - Table 27 in Appendix 4 summarizes all values used to run both mean value (Garrick, et al. 2003) and Monte Carlo simulations.

Suitable distributions were assumed: lognormal distribution for the indoor microenvironmental concentrations (country differentiated), as seen in Appendix 4, while normal distributions were assumed for the physiological/biokinetic parameters reported in Appendix 3.

All MC calculations were executed with 10.000 iterations.

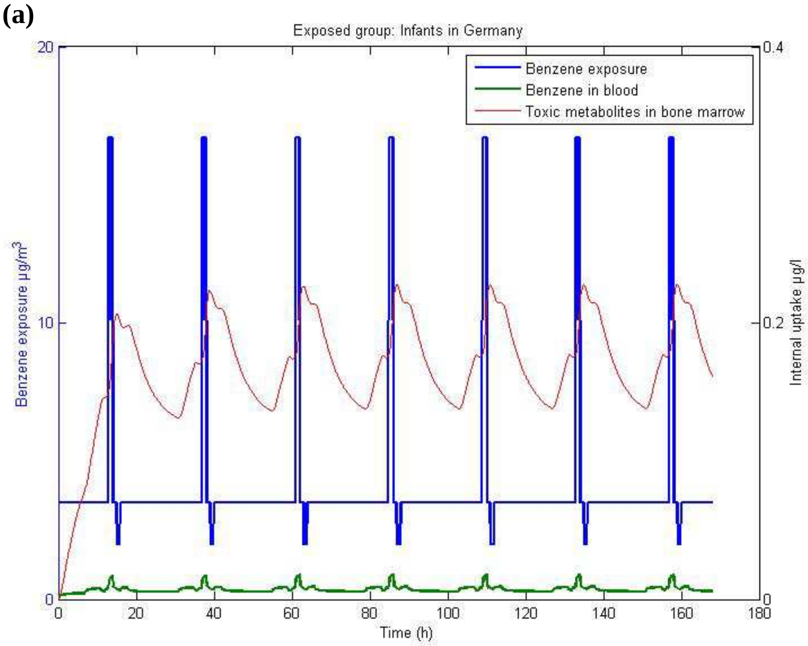
Step 8: Interpreting and reporting the output

Diurnal variability computations

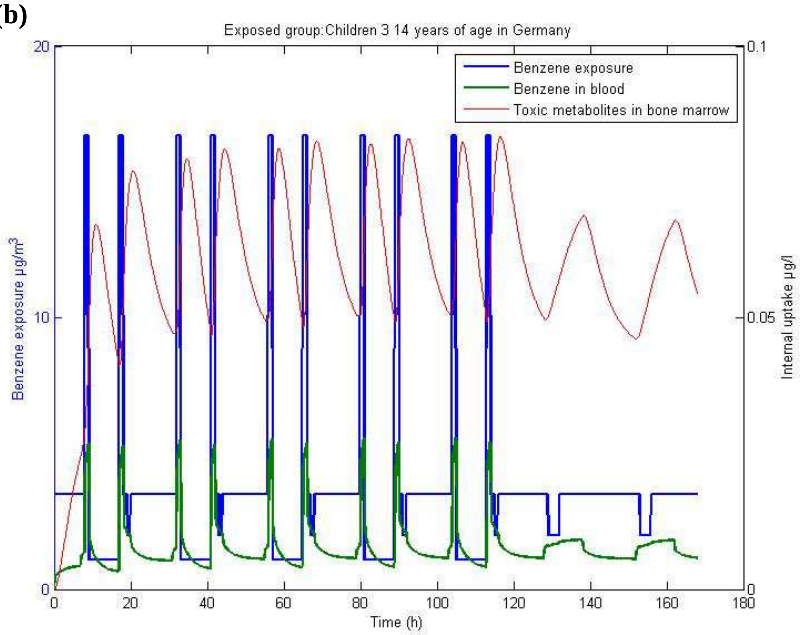
The following set of figures (Figure 5) illustrate the diurnal variation of benzene exposure and internal dose to all exposed groups in Germany, as an indicative example. Results for all the others EU Countries are reported in Appendix 5.

According to Figure 8, internal dose to toxic metabolites in the bone marrow is higher for infants, a fact explained by the relatively higher uptake (or bodyweight normalized dose). The same but to a smaller extent occurs for the children aged 3-14, while gender differences between adults seem to be of minor importance, as a result of the small differences in exposure profiles and physiology

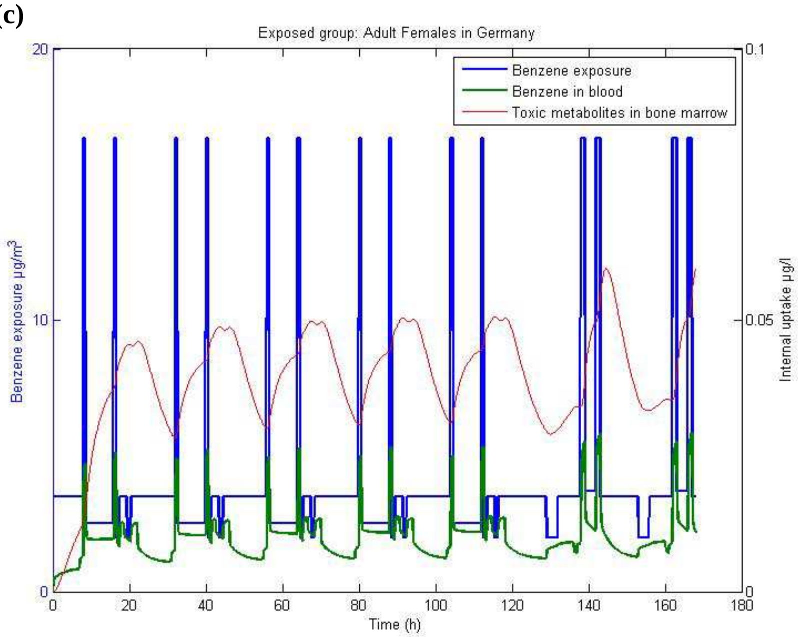
(a)



(b)



(c)



(d)

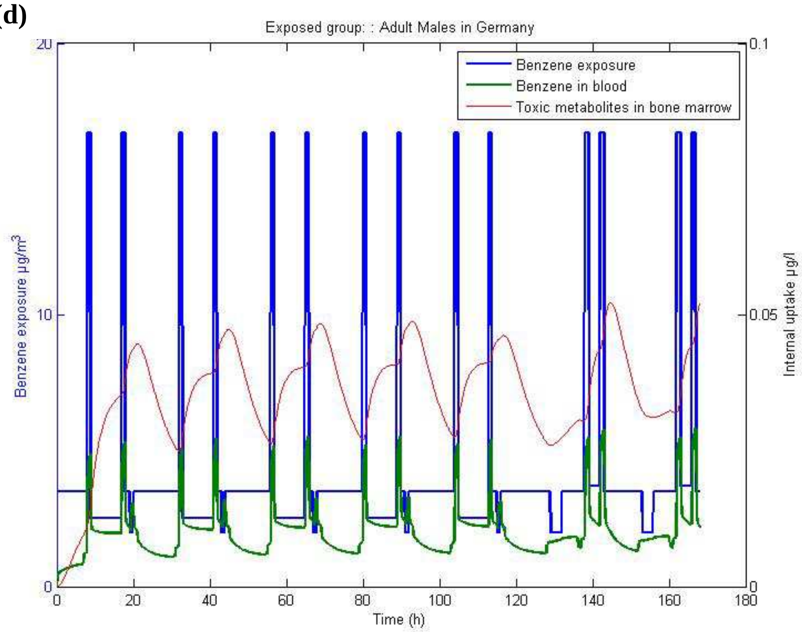
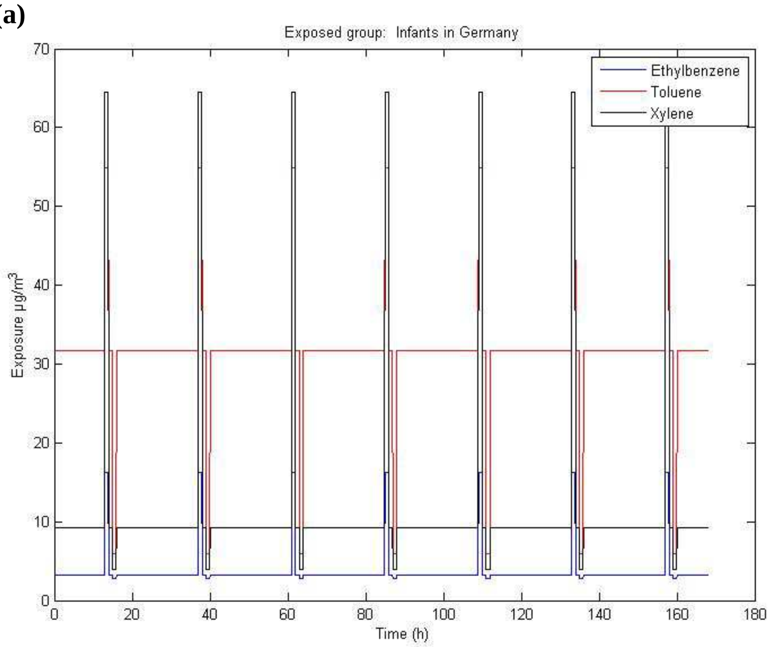


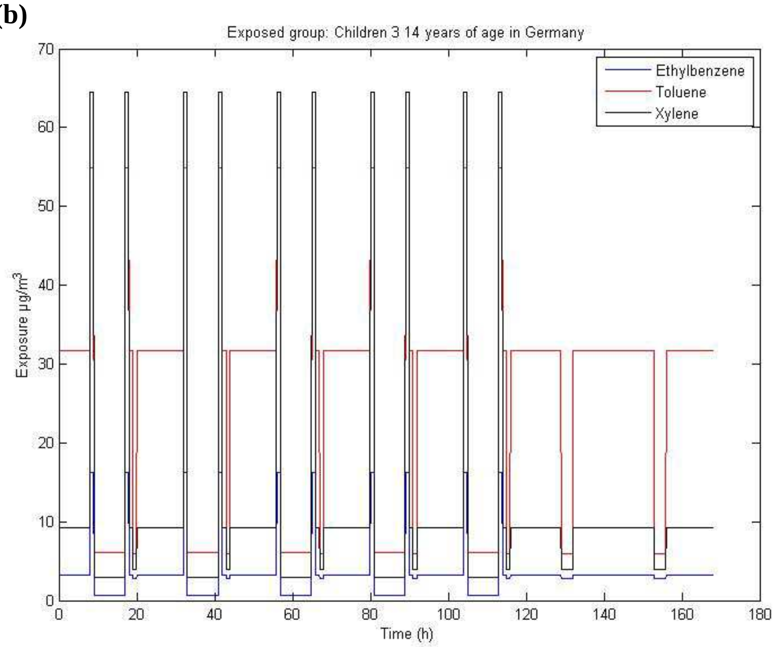
Figure 8. Benzene exposure and internal intake for four exposed groups for a representative week in Germany. (a) Infant, (b) 3-14 years, (c) Adult females and (d) Adults males

Diurnal variability for TEX exposure in Germany is presented in Figure 9. Similarly to above, the intra-day variability is attributed to the different activities and the related micro-environmental concentrations. Similar results for all other EU countries are reported in Appendix 6.

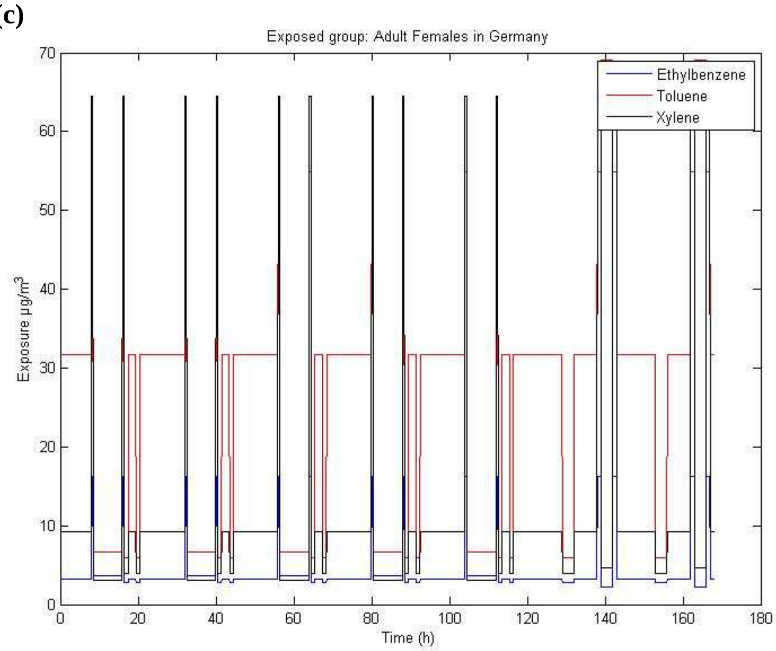
(a)



(b)



(c)



(d)

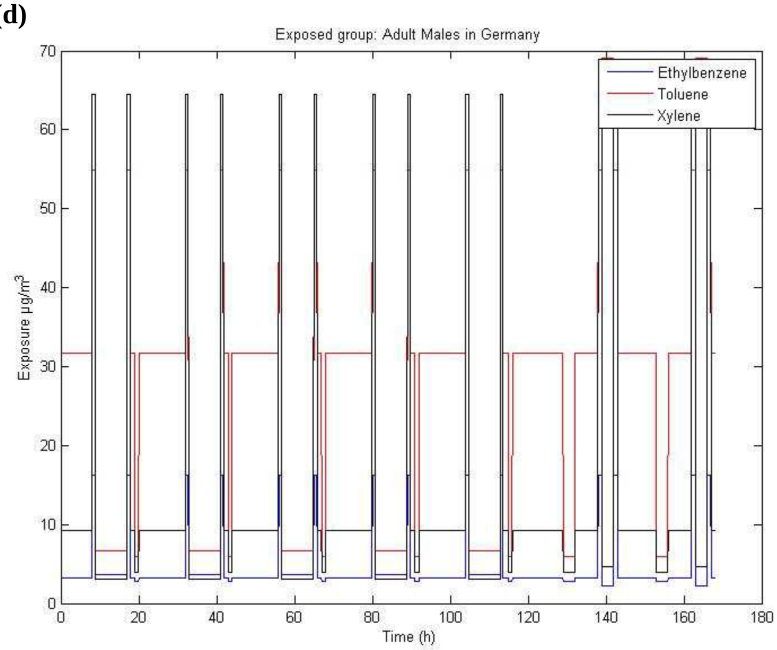


Figure 9. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week in Germany. (a) Infant, (b) 3-14 years, (c) Adult females and (d) Adults males

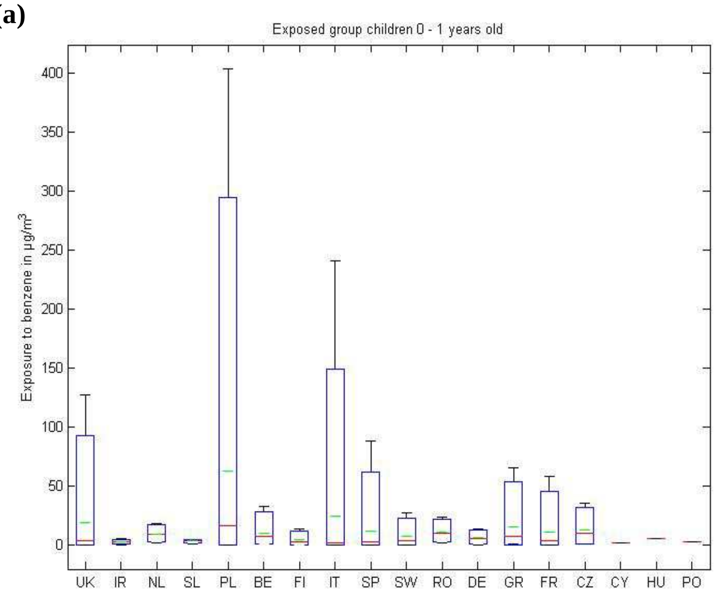
Average weekly – Monte Carlo simulations

BTEX exposure and uptake

In the following group of Figures, the calculated BTEX exposure and uptake are presented for the most vulnerable exposed groups, children below 1 year of age (infants). Results for all other age groups are reported respectively in Appendix 7 in charts and in Appendix 8 in tabular format.

In all whisker plots reported below the rectangular box represents the 5 and 95 percentile, the two whiskers (black vertical and horizontal lines) are the minimum and maximum values the red line is the median and the green line represents the mean value.

(a)



(b)

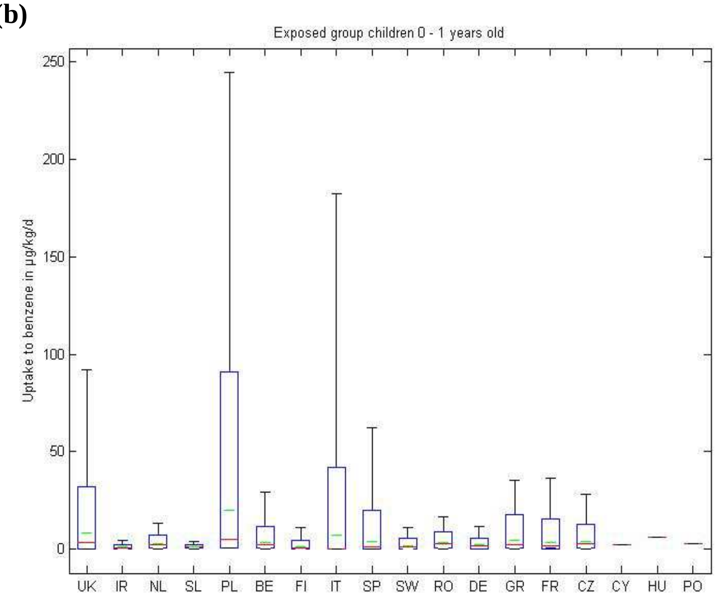
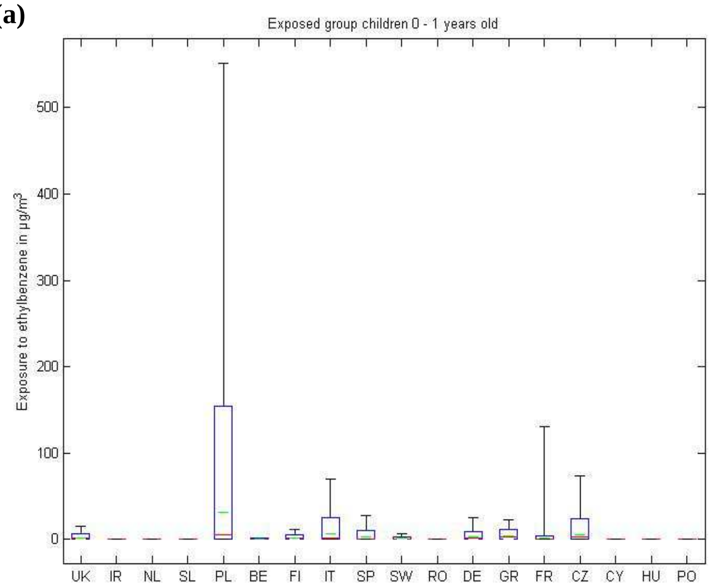


Figure 10. Whisker plot for benzene, exposure (a) and uptake (b) for infants- In green are shown the mean estimates.

According to the left panel of Figure 10, the highest mean concentrations are in Poland (62.9 μg/m^3),, Italy (24.7 μg/m^3), UK (18.99 μg/m^3), Greece (15.6 μg/m^3) and Spain (12.5 μg/m^3). Alternatively, the highest computed concentrations are for Poland (404.1 μg/m^3), Italy (240.7 μg/m^3), UK (127.2 μg/m^3) and Spain (88.6 μg/m^3). Estimated uptake values are in-line with the highest mean uptake estimates in Poland (19.8 μg/kg/d), UK (8.21 μg/kg/d), Italy (7.2 μg/kg/d) and Spain (4.2 μg/kg/d). Furthermore, the highest computed uptake estimates are 244.7 μg/kg/d in Poland, 182.2 μg/kg/d in Italy, 91.9 μg/kg/d in UK and in Spain 62.6 μg/kg/d.

(a)



(b)

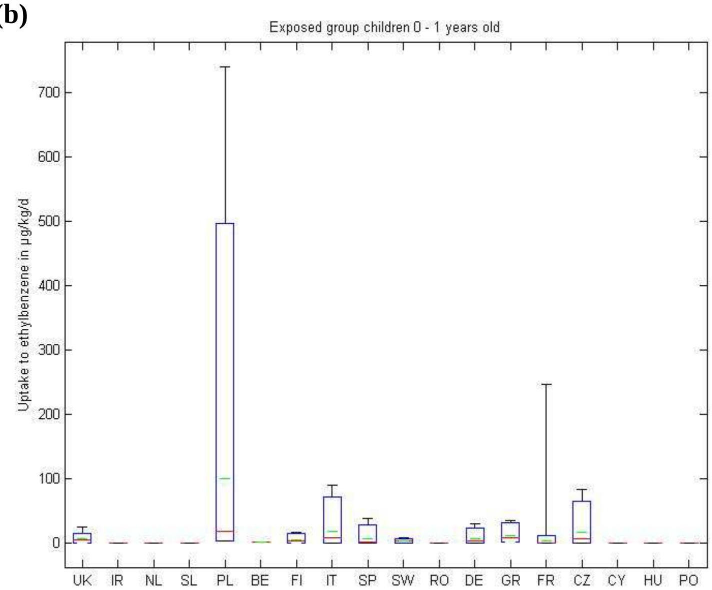
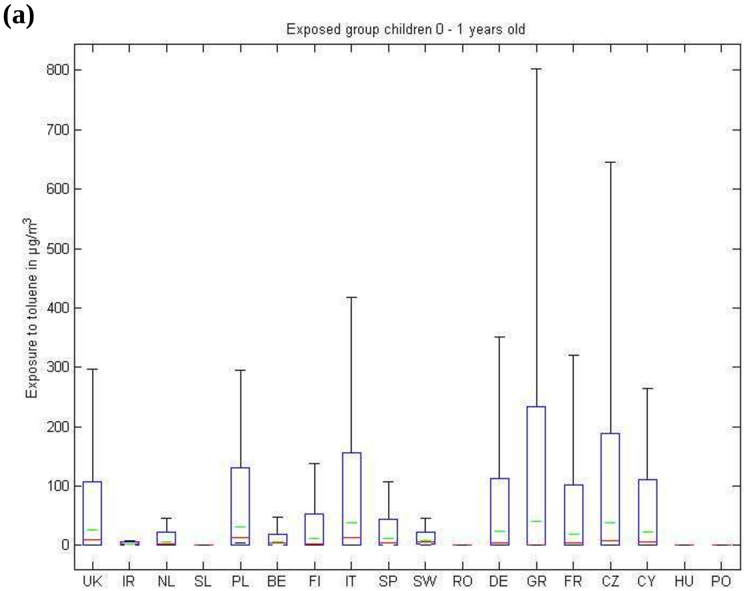


Figure 11. Whisker plot for ethyl-benzene, exposure (a) and uptake (b) for infants- In green are shown the mean estimates.

According to Figure 11, the highest mean exposure concentrations are in Poland (31.8 μg/m^3), in Italy (6.1 μg/m^3), in Czech Republic (5.7 μg/m^3) and in Greece (3.7 μg/m^3). The maximum computed exposure concentrations are in Poland (551.7 μg/m^3), in Greece (131.1 μg/m^3), in France (131.1 μg/m^3), in Italy (69.2 μg/m^3). Furthermore, according to the right panel of Figure 11, maximum mean uptake estimates are for Poland (100.9 μg/kg/d), Italy (19.1 μg/kg/d), Czech Republic (17.4 μg/kg/d) and Greece (12.1 μg/kg/d). In accordance the highest computed concentrations are in Poland (741.1 μg/kg/d), France (246.4 μg/kg/d), Italy (90.3 μg/kg/d) and Czech Republic (246.4 μg/kg/d).

(a)



(b)

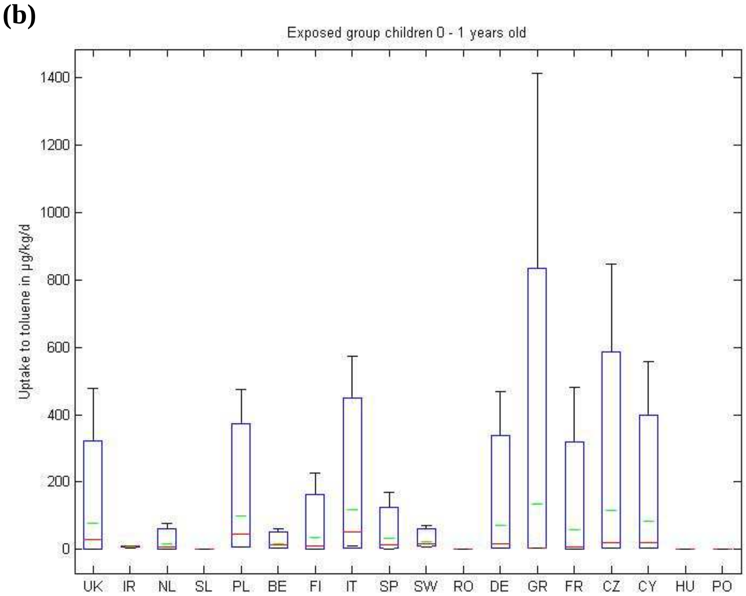
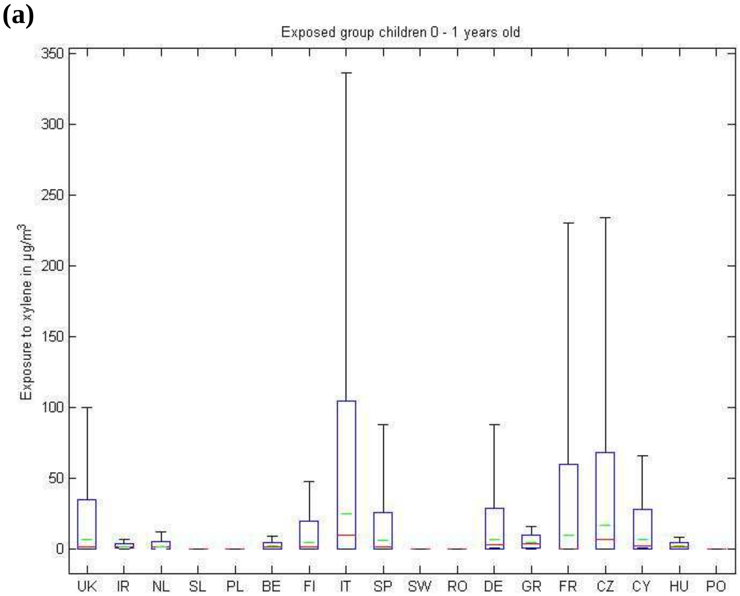


Figure 12. Whisker plot for Toluene, exposure (a) and uptake (b) for infants- In green are shown the mean estimates.

According to Figure 12, the highest mean concentrations for toluene are in Greece (40.2 μg/m^3), Czech Republic (37.9 μg/m^3), in Italy (37.8 μg/m^3), in Poland (31.6 μg/m^3), in UK (24.9 μg/m^3), in Denmark (23.5 μg/m^3) and Cyprus 22.7 μg/m^3. As expected the highest computed concentration are in Greece (803.1 μg/m^3), in Czech Republic (646.0 μg/m^3), in Italy (418.7 μg/m^3), in Denmark (351.3 μg/m^3), in France (319.8 μg/m^3), in UK (297.6 μg/m^3), in Poland (295.5 μg/m^3) and in Cyprus (263.8 μg/m^3). In accordance, from the right panel of Figure 12, the highest computed mean uptake values are in Greece (133.7 μg/kg/d), in Italy (118,5 μg/kg/d) and in Czech Republic (116.6 μg/kg/d). It is noted that the highest computed concentrations are in Greece (1414.9 μg/kg/d), Czech Republic (846.4 μg/kg/d) and in Italy (574.7 μg/kg/d).

(a)



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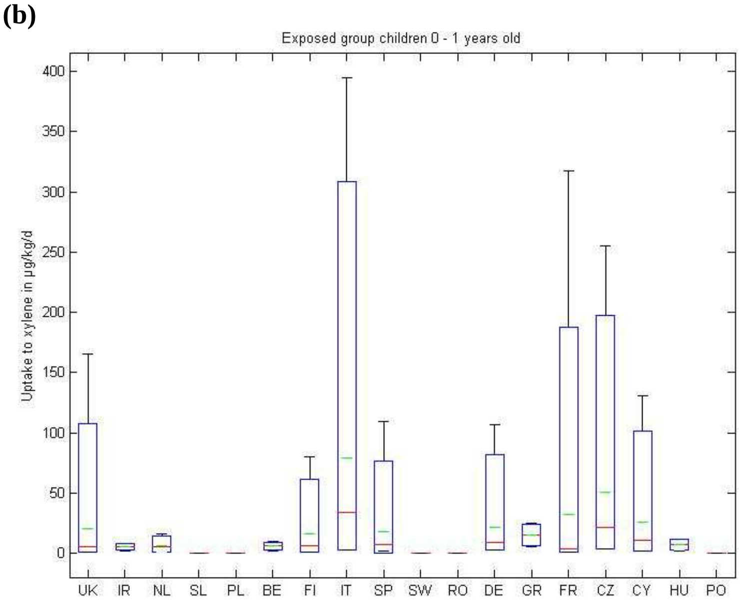


Figure 13. Whisker plot for Xylene, exposure (a) and uptake (b) for infants- In green are shown the mean estimates.

According to Figure 13, the highest mean concentrations are in Italy (25.2 μg/m^3), Czech Republic (16.8 μg/m^3), France (10.4 μg/m^3), Denmark (7.2 μg/m^3) and in Cyprus (7.0 μg/m^3). In addition, the highest computed concentrations are in Italy (336.6 μg/m^3), in Czech Republic (233.9 μg/m^3), in France (230.1 μg/m^3) and in UK (99.9 μg/m^3). Furthermore, based on the right panel from Figure 13, the highest maximum uptake values are in Italy (79.6 μg/kg/d), in Czech Republic (51.1 μg/kg/d), in France (31.8 μg/kg/d) and in Cyprus (26.2 μg/kg/d). The maximum uptake estimates are in Italy (394.9 μg/kg/d), in France (317.3 μg/kg/d), in Czech Republic (255.5 μg/kg/d), in UK (165.6) and in Cyprus (131.0 μg/kg/d).

Benzene in blood

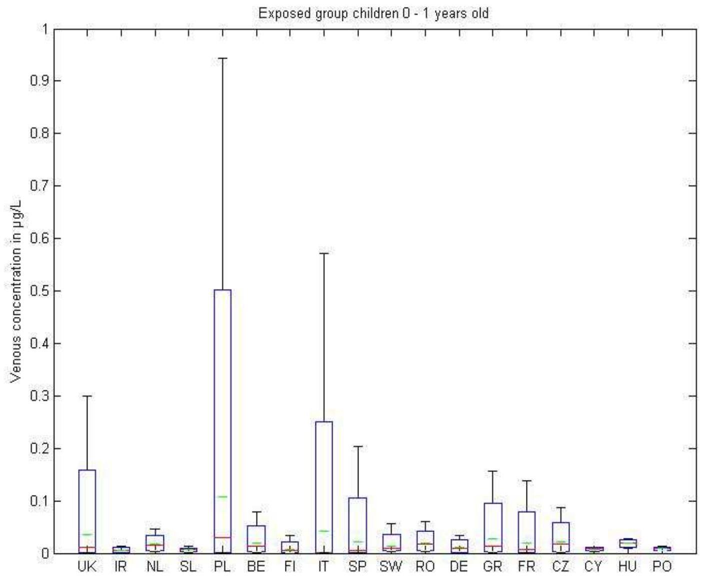


Figure 14. Whisker plot of benzene concentration in blood (in green the mean estimates) for infants

Variation in venous concentration are presented using Whisker plots; which are modified accordingly to include median (red line), mean (green line), 5% and 95% percentiles, minimum and maximum estimates. Hence, according to Figure 14, the highest computed concentration for infants, are in Poland, Italy, UK and Spain. Furthermore, concentration distribution is strongly lognormal with highest values ranging from 0.3 μg/l to 1 μg/l. These high venous concentrations are in accordance to the elevated maximum concentrations indoors (home); for example maximum concentrations in Poland, Italy, UK and Spain are at 404 μg/m^3, 242 μg/m^3, 128 μg/m^3 and 89 μg/m^3. Alternatively, the computed mean estimates for these countries are 0.11 μg/L, 0.04 μg/L, 0.03 μg/L and 0.02 μg/L respectively.

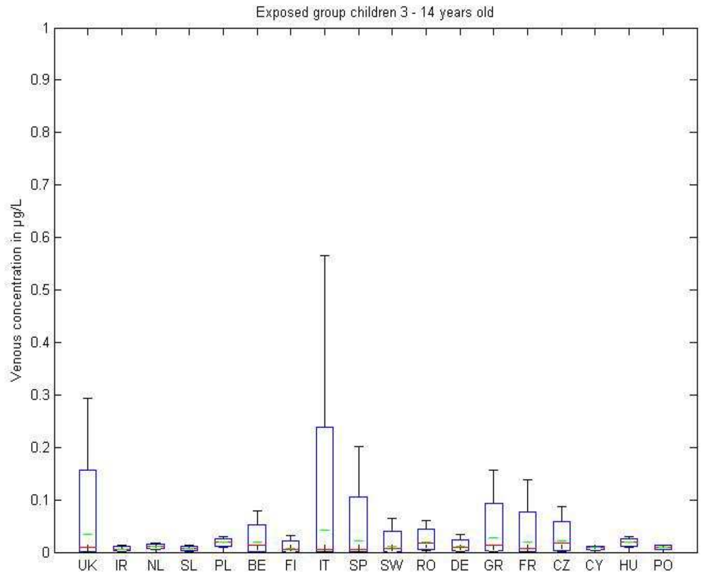


Figure 15. Whisker plot of benzene concentration in blood (in green the mean estimates) for children aged from 3 to 14

In Figure 15, the highest mean concentrations are identified in Italy (0.04 μg/l), Greece (0.03 μg/l), and UK (0.03 μg/l). In accordance the maximum computed concentrations are in Italy (0.57 μg/l), in UK (0.29 μg/l), Spain (0.20 μg/l), Greece (0.16 μg/l) and France (0.14 μg/l). Low venous concentrations are identified in Ireland, Netherlands, Slovenia, Poland, Finland, Germany, Cyprus, Hungary and Portugal.

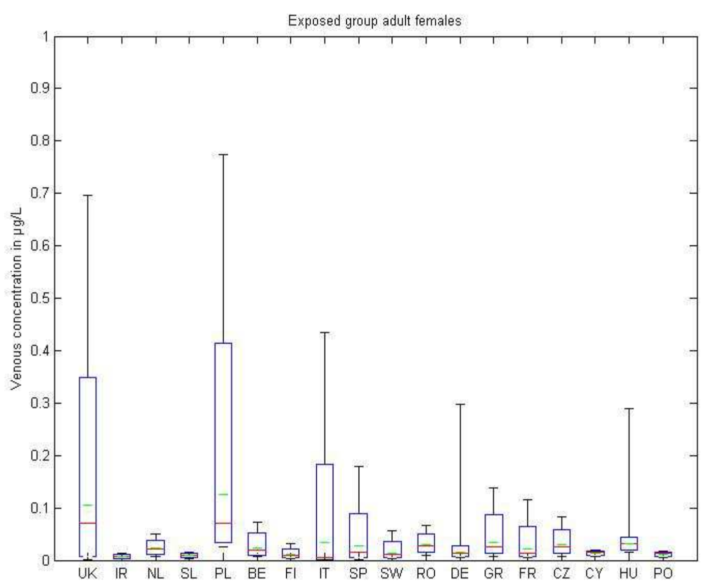


Figure 16. Whisker plot of benzene concentration in blood for adult females

In Figure 16, the Whisker plot illustrate variations in venous benzene concentration for adult females; it is identified that maximum concentrations reach values up to 0.8 μg/L for Poland, 0.7 μg/L for UK, 0.45 μg/L for Italy and 0.3 μg/L for Germany and Hungary. The highest mean estimates are in Poland (0.13 μg/L) and UK (0.11 μg/L).

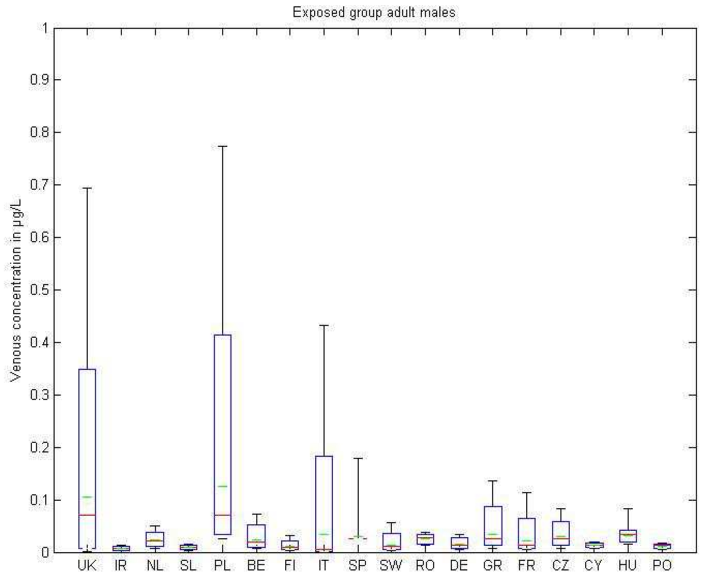


Figure 17. Whisker plot of benzene concentration in blood (in green the mean estimates) for adult males

In Figure 17, using the Whisker plots the highest concentrations are identified in Poland (0.13, max at 0.77 µg/L), UK (0.11 max at 0.70 µg/L) and Italy (0.03 max at 0.43 µg/L).

Benzene toxic metabolites (BO, PH, HQ) concentration in bone marrow

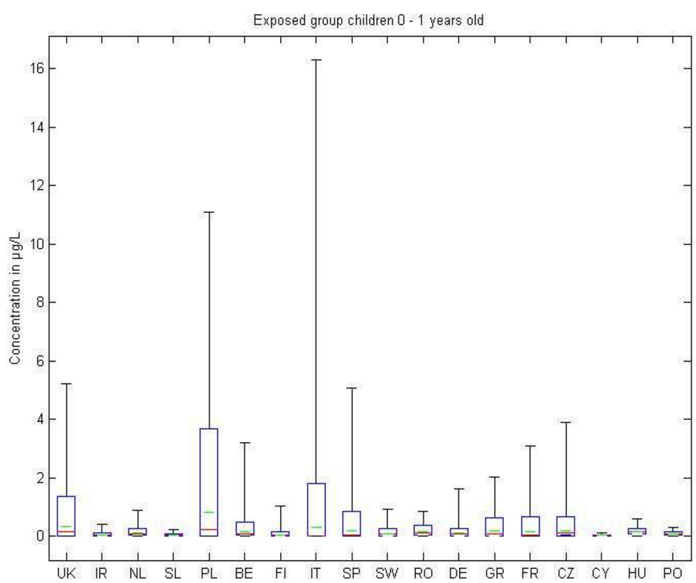


Figure 18. Whisker plot of benzene toxic metabolites (BO, PH, HQ) concentration in bone marrow for infants

According to Figure 18, the highest mean values are in Poland (0.83 µg/L), UK (0.34 µg/L), Italy (0.31 µg/L) and Czech Republic (0.21 µg/L). Alternatively, the maximum concentrations are estimated in Italy (16.30 µg/L), Poland (11.09 µg/L), UK (5.23 µg/L) and Spain (5.06 µg/L).

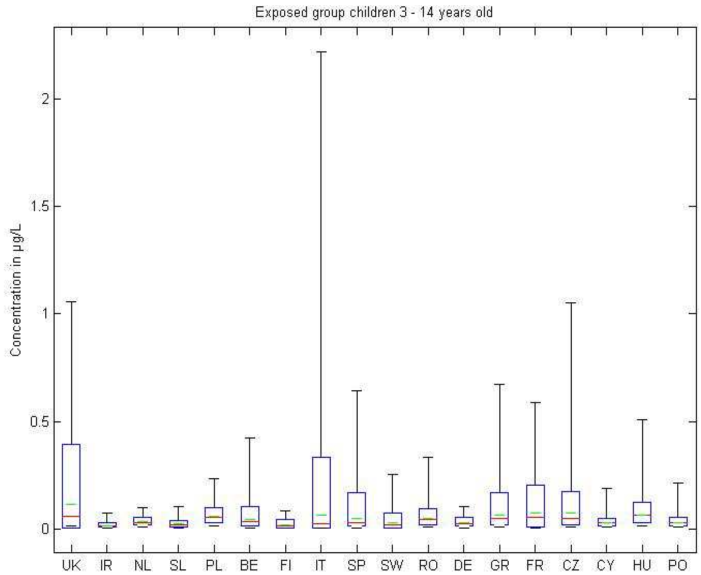


Figure 19. Whisker plot of benzene toxic metabolites (BO, PH, HQ) concentration in bone marrow for children aged 3 to 14

According to Figure 19, the highest mean values are in UK (0.11 μg/L), France (0.07 μg/L), Hungary (0.07 μg/L), Poland (0.06 μg/L), Italy (0.06 μg/L) and Greece (0.06 μg/L). Alternatively, the highest computed concentrations are in Italy (2.22 μg/L), UK (1.06 μg/L) and Czech Republic (1.05 μg/L).

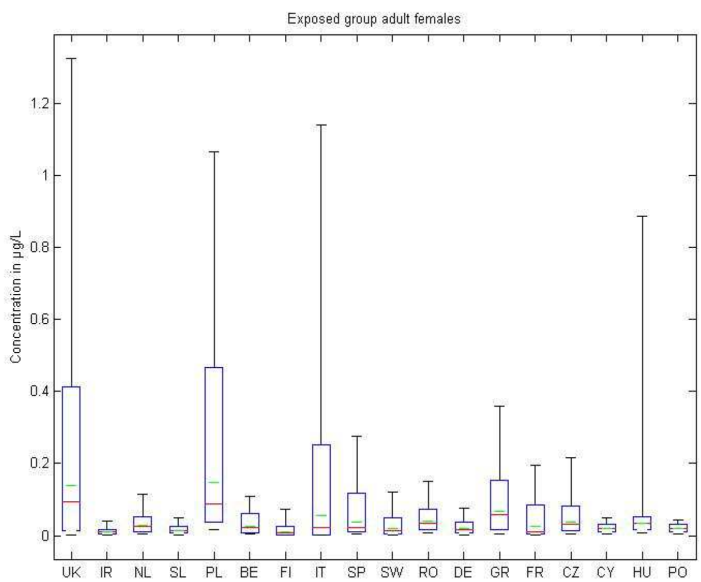


Figure 20. Whisker plot of benzene toxic metabolites (BO, PH, HQ) concentration in bone marrow for adult females

According to Figure 20, the highest mean benzene concentration in bone marrow are in Poland (0.15 μg/L) and UK (0.14 μg/L). Maximum concentrations are identified in UK (1.32 μg/L) , Italy (1.14 μg/L), Poland (1.06 μg/L) and Hungary (0.89 μg/L).

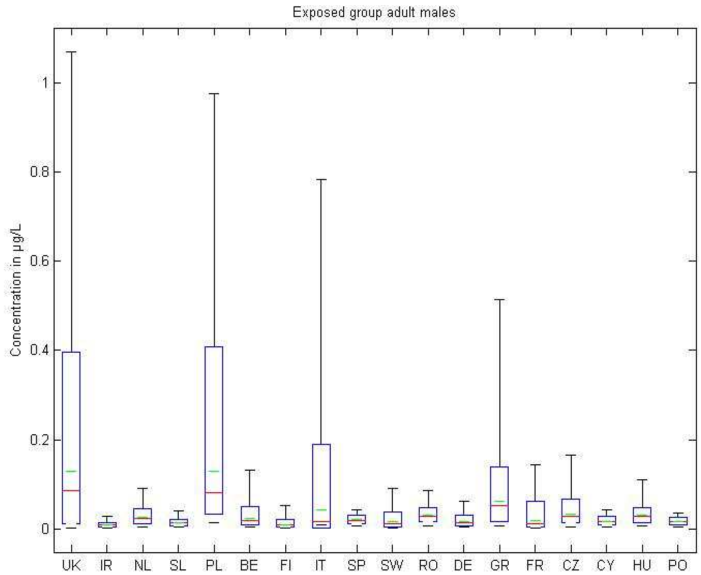


Figure 21. Whisker plot of benzene toxic metabolites (BO, PH, HQ) concentration in bone marrow for adult males

According to Figure 21, the highest mean concentration estimates are in Poland and UK (both at 0.13 μg/L), where the other countries concentrations are in low magnitude close to 0.02 to 0.04 μg/L. In accordance, the maximum computed concentrations are 1.07 μg/L in UK, 0.98 μg/L in Poland, 0.78 μg/L in Italy.

Discussion

General issues

Carrying out an EU indoor air BTEX exposure assessment is a challenging and demanding task. A major difficulty arises from the relative paucity of data in many of the EU countries, especially from the newer member states. However, even at the countries where data exist, there are significant problems and inconsistencies in the respective datasets. A major issue is that nationally representative indoor air BTEX data are only available from Germany by the GerES II &IV studies (Hoffmann, et al. 2000; Ullrich, et al. 2002), England (Raw, et al. 2004) and France (Kirchner, et al. 2006). The English and French data do not include ethylbenzene. Yet, large variation in the measured data might be expected due to socio-economical differences, affecting both consumer product use and building materials/emission sources, and/or climatic differences that may affect the indoor/outdoor air exchange. Moreover, BTEX are emitted by strong traffic sources and penetrate to the indoor air (benzene is the most characteristic example); thus traffic load and management (which strongly depend on the degree of urbanization) also affect IAQ. All of the above determine the representativeness of measurement campaigns. Other determinants are the number and the distribution of samples collected. In many studies, the number of samples and/or the combination of the selected dwellings (mixed occupational and non-occupational settings) are not adequate for considering them representative of the entire urban area. Finally, the way that the results are very often presented in literature lacks consistency with regard to the statistical metrics used, obstructing data interpretation. A realistic and representative view to indoor exposure of the wider population would be greatly facilitated by a sampling harmonization protocol that provides guidance on the number and spatial distribution of samplers (at the country and urban scale) taking into account the arguments discussed above as well as on the way of presenting the results so that they can be easily utilized by other experts and policy makers.

The overview of the results indicated that for some contaminants a wide variability is observed, due to the different source characteristics. Thus, their presence is limited to regions where socio-economic, regulatory or consumer behaviour reasons greatly affect indoor air quality. However, also possible strong outdoor emission sources and out-to-indoor air penetration might have a more significant contribution than indoor sources, making source apportionment even more complicated.

Fuel- and solvent-related compounds such as BTEX are two to three times more abundant in the indoor air in the south than in the north of Europe. This is mostly associated to indoor sources such as building materials and ETS and outdoor sources such as transport; the latter have a much higher influence on indoor air concentrations in the south than in the north, because of the higher out-to-indoor air penetration observed due to the different climate (much warmer in the south. Xylenes are also much higher in the south than the north of Europe even though their origin is more indoor-based. This can be explained primarily by the relative prevalence of cigarette smoking in the south compared to the north of Europe, even though many building materials like carpets and parquet floor covering, which are significant sources of the two chemicals, are widely used in northern Europe – once more, due to the relatively colder climate.

There is a need to consider regulating sources and other indoor air pollution determinants in residential and non-residential environments mostly by:

- Emission characterization and labeling schemes for building materials, household appliances and consumer goods. This is an effort that is currently on-going at the EU level, e.g. through dedicated working groups of CEN, the Blue Angel scheme in Germany, the EU LCI working group, and ad hoc projects such as BUMA (DG SANCO) and EPHECT (DG RTD - FP7).

- Issuing guideline values for major indoor air chemicals at the WHO and European Commission level. Given the globalization of trade, it is essential that such guidelines are proposed and endorsed by the WHO.
- Publicizing good practices in handling newly acquired consumer goods (destined for primarily indoor use), maintenance of older products, substitution of toxic chemicals in articles with less toxic ones (e.g. naphthalene in moth balls)

Given the complexity and the differences in the chemical composition of the indoor air chemical mixture in Europe, there would be scope for addressing the combined exposure of the population to airborne chemical mixtures characteristic of specific environmental settings in order to assess the potentially attributable health risk and identify the most appropriate risk management strategies. Considering also the relatively large variance of concentration values for most of the chemicals reviewed herein within the same city (especially for dwellings) it is essential to include in future studies analyses of the socio-economic determinants that may affect population exposure to indoor air chemicals.

Methodological considerations

From the methodological point of view, the INTERA methodology is a clear advance towards the refinement of exposure assessment. Although measurements of personal exposure comprise an advancement in exposure/risk assessment compared to environmental monitoring, the process might be further enhanced by translating external exposure to actual uptake and even more to internal dose metrics.

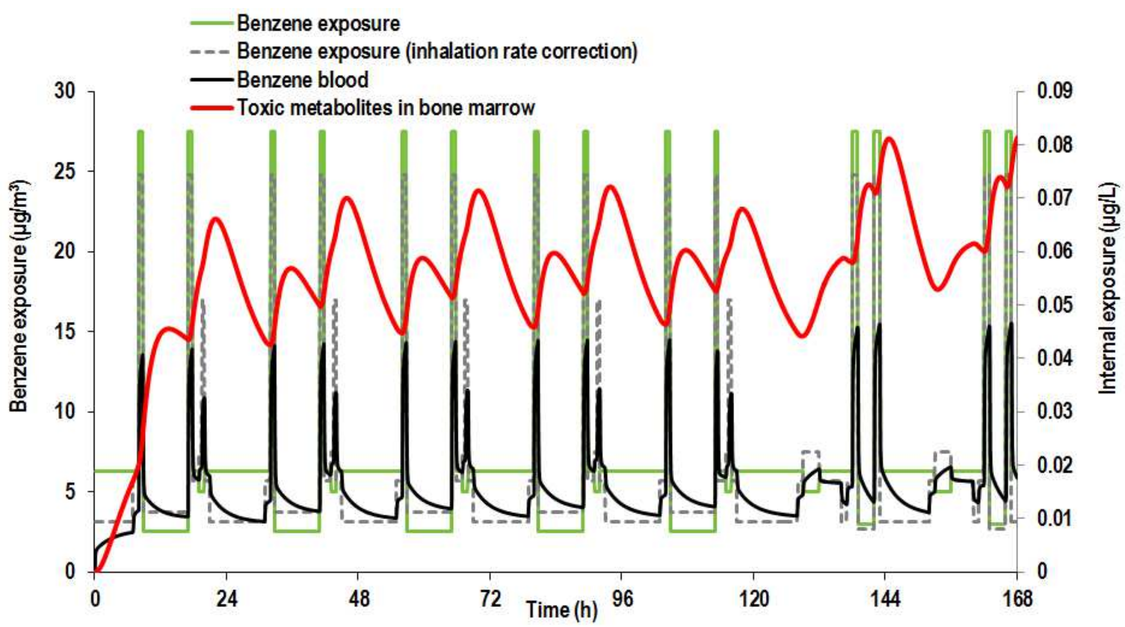


Figure 22. Benzene exposure, inhalation corrected exposure, benzene in the blood and the sum of benzene toxic metabolites in bone marrow.

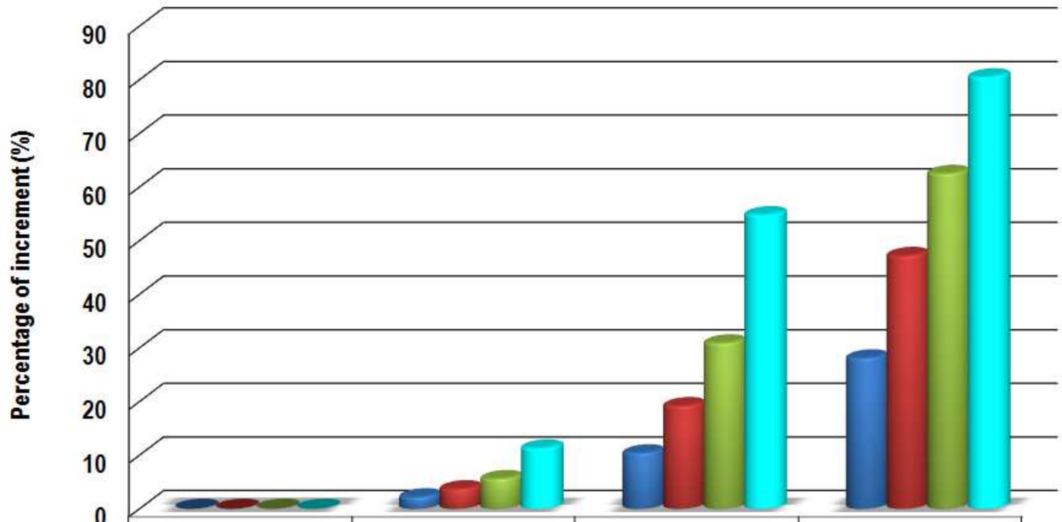
The progressive steps for exposure assessment refinement are illustrated in Figure 22. The green line indicates the personal exposure as calculated by the usual formulas of exposure taking into account micro-environmental time concentrations and time activity patterns. The grey line indicates the exposure to benzene, when the intensity of activity is taken into account, which in turn affects the overall uptake. Thus, although someone might stay within a location (characterized by constant levels of contamination) for a specific duration, actual exposure might be different for sub-regimes of this duration, based on the intensity of activity. Translating this exposure to benzene internal exposure, we obtain a relatively different curve. Should the neurological impairment caused by benzene was the aim of the study, this curve would be a key element. Since in common environmental settings we are more interested in benzene carcinogenic potential, concentration of toxic metabolites in the target tissue (bone marrow) is the actual exposure metric. This curve (in red) is significantly differentiated in form by the exposure curve (green line), allowing also the room for possible bioaccumulation under specific exposure patterns. In addition, the lower response of this curve to external exposure peaks, is useful for understanding significant misconceptions in exposure/risk assessment: peaks of exposure events of short duration (e.g. car refueling by a non-occupant) is less important than prolonged exposure to elevated "background" exposure levels (e.g. living close to a heavily trafficked road).

Another advantage of a comprehensive internal dose analysis is the investigation of interactions among the selected contaminants at the levels of metabolism. Although the mechanism of interaction among BTEX is well known fact, this interaction takes place at exposure levels, significantly beyond the ones found in the study. The interaction effect due to concurrent exposure to a chemical mixture can be better appreciated when the exposure levels are higher with respect to typical environmental exposures. This is the case for occupational exposure characterized by exposure levels of the same order of the Threshold Limit Value (TLV) for all the four substances composing the mixture. TLV is defined as "the concentration of a substance to which most workers can be exposed without adverse effects". These limit values are defined taking into account exposure to only individual chemicals. Therefore, it is of great interest to verify if simultaneous exposure to a mixture containing multiple chemicals could vary the effective dose to the target organs.

The TLV's for the four chemicals considered here are:

- Benzene: 1.60 mg/m^3
- Toluene: 124.36 mg/m^3
- Xylenes: 217.10 mg/m^3
- Ethylbenzene: 217.10 mg/m^3

To evaluate the effect of the interaction, Sarigiannis and Gotti (2008) compared the internal dose of benzene in the bone marrow when workers are exposed to benzene alone at TLV vs. when they are co-exposed to the quaternary BTEX mixture, assuming for each chemical exposure levels at several fractions of the respective TLV, following a typical 8-hours daily exposure scenario. The result of the comparison is shown in Figure 23. Benzene concentration in the bone marrow is higher under combined exposure to BTEX with respect to exposure to benzene alone. To better evaluate the effect of the interaction among the different VOCs composing the BTEX mixture the increment is reported as percent of the corresponding internal dose associated to benzene alone. These increments can be estimated to range between 2% and 80% respectively for exposure to BT at TLV/3 and to BTEX at TLV. The resulting change in internal dose of benzene metabolites in the bone marrow and increased concentration of benzene in the blood lead to an increased risk of neurotoxicity and a slightly lower risk of leukemia to healthy individuals after lifelong exposure compared to exposure to the same levels of benzene alone.



	B	B+T	B+T+X	B+T+X+E
TLV/3	0	2.2	10.4	28.1
TLV/2	0	3.7	19.2	47.2
TLV(2/3)	0	5.6	30.9	62.5
TLV	0	11.3	54.8	80.5

Figure 23. The effect of BTEX interaction under different exposure levels. Y axis represents the increment (%) of the internal dose of benzene in the bone marrow associated to different mixture exposure scenarios reported on X axis when compared to exposure to benzene alone.

Steps towards an indoor air sampling harmonization protocol

Though some efforts are ongoing in this direction (e.g. INDOOR MONIT project – DG SANCO), currently there is no Community or national legislation in Europe that prescribes explicitly a monitoring and control program for indoor air quality. Consequently, no EU-wide systematic indoor air monitoring data exist. Harmonized criteria on monitoring requirements and the development of harmonized protocols will improve exposure assessment of indoor air pollutants. The harmonized protocols must include pollutants to be measured, standardized analytical techniques to be employed, survey designs (including standardized questionnaires), target locations for measuring exposure (e.g., kindergartens, schools, offices, private dwellings, day care centers, hospitals, transportation vehicles), periods and frequencies of measurements, range and distributions of concentrations, target population groups (general public, susceptible groups, etc) and statistical tools for data evaluation. As already mentioned above, one of the major difficulties encountered in the current study for proper data interpretation as well as for exposure assessment was the lack of adequate data and the extent to which these data are representative of the exposure settings they referred to. Thus, in view of optimizing the exposure assessment procedure, while containing the sampling/measurements cost, we suggest the following criteria for a sampling protocol framework towards harmonization in indoor air measurements:

- The number of samples should be representative of the population. A ratio of one sampler per thousand residents should be the minimum in order to effectively support the assessment process with adequate and representative data.
- The distribution of samplers within the city. This is very important since within the limits of a large urban agglomeration, the intra-urban variability of indoor air concentrations is in

general seen to be higher compared to inter-urban or, even, inter-country variability for the same climatic zone according to the data collected thus far. Thus, “density” of samples should be higher in more populated areas, so that the mean value represents with less uncertainty the actual exposure of the population. If a sufficiently large sample can be collated, a probability sample randomly drawn from the target population and/or indoor spaces is the ideal choice. It will also cover the monitoring locations listed above in a representative way and allow for generalization of the results.

- Sampling in residential and non-residential locations. Indoor air concentration data are needed from the majority of the locations encountered by the population; thus, besides dwellings, a significant number of samplers (about one third) should be placed in non-residential locations. Special attention should be paid to children, considering that they constitute the most vulnerable group among the members of a population from the point of view of public health. At least half the samples taken from non-residential locations should be devoted to assessing indoor air quality in schools and kindergartens. Overall, the following locations are characteristic for designing a representative indoor air survey:
    - City centre
    - Suburban/residential
    - Urban background
    - Rural background
    - Sites in proximity to major roads/streets
    - Sites in proximity to specific industrial site(s)
    - Specific source/target-oriented (e.g., garages, car parks, tunnels, schools, hospitals, kindergartens, public buildings, etc)

- Sampling distribution within the country. The variation of indoor dwellings concentrations in the cities within a country might vary based on several differences discussed above. However, an overview of the situation in the whole country is necessary and for this reason, considering also the cost of sampling, the cities should be clustered by relevance criteria; one city from each *cluster* should be the field of a measurement campaign as described above. The criteria for clustering the cities refer to either a) strong outdoor sources/ high concentrations, which affect the indoor concentrations by penetration of ambient air indoors; or b) purely indoor emission processes and sources. Thus, possible clustering criteria should comprise:
    - degree of urbanization and population density, which affects traffic volumes and ambient air pollution
    - meteorological conditions and local topography, which affect indoor-to-outdoor air interactions, as well as the use of ventilation, heating or cooling devices etc.
    - existence of industrial sites or power generation plants nearby the urban location
    - socioeconomic status of the urban population, a parameter which affects consumer products choice, use pattern and consequently indoor air emissions
    - information on the specific building materials and consumer products/apparatus used in the indoor environment sampled

- Duration and type of sampling. BTEX indoor air sampling is usually carried out by passive sampling (which is also the case of the majority of the studies reviewed in this paper). Passive sampling presents numerous advantages, such as:

- lower cost of samplers
- no need for electric power
- longer period of sampling, providing thus more information for chronic exposure assessment purposes

However, passive sampling data are time-integrated and thus have low temporal resolution, a problem that does not exist when active sampling is used. The concentrations detected in the reviewed studies are average concentrations, but we ignore the history of the diurnal concentration profiles (for example the concentrations of BTEX are significantly higher right after the application of cleaning products or smoking). Acute health effects, however, may be triggered when a defined exposure level is exceeded. With passive sampling this kind of information is completely lost, a fact that could modify the overall risk assessment significantly. Although low time resolution is adequate for long term exposure assessment, when acute effects (e.g. eye, lung or skin irritation) are concerned, peak exposures might be important and a higher temporal analysis is needed. Moreover, with passive sampling, the identification of indoor air concentration determinants is either described qualitatively, or it is not sufficiently quantified with statistical methods. Thus, when significant temporal variation is expected in an indoor location (either due to strong outdoor contributions such as proximity to heavily trafficked streets, or to indoor activities as smoking, cooking or cleaning) and when active sampling is available, at least a day of hourly monitoring over a 24-hr period is indispensable (typical diurnal profile). The best solution seems to be a combination of active and passive sampling as proposed by Karakitsios et al (2010). Since passive sampling is proper for giving an overview at low temporal resolution but wide areas can be included with relatively low cost, still remains the method of choice. However, for optimizing the assessment procedure, active sampling should be applied additionally, in order to capture indoor air quality dynamics under specific activities accompanied by strong emissions (as the ones just described above). Furthermore, under the frame indoor air exposure assessment, active sampling measurements can target specific activities and microenvironments, elucidating thus their respective role in the definition of the overall exposure profile. On the contrary, passive sampling measurements demand a sufficiently high number of volunteers, making it difficult to represent homogeneously the exposure pattern of the population.

- Repetition of the sampling. Seasonal variation might significantly alter indoor concentrations due to differences in ventilation, indoor/outdoor interaction, use of space heating etc. At least a two-season campaign (winter and summer) is necessary in each sampling location.

Technical details of recommended method on chemical analysis for the indoor pollutants referred in the study (BTEX) is described in ISO-16000-6 based upon active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using mass spectrometry or flame ionization detection. Moreover EN 14662-5:2005[2] identifies a suitable standard method for measurement of benzene concentrations in air based upon diffusive sampling followed by solvent desorption and gas chromatography.

[2]http://shop.bsigroup.com/ProductDetail/?pid=000000000030093665

Conclusions

- There are significant data gaps with regard to the indoor concentrations data on BTEX across EU. There is a need for harmonized and representative EU indoor concentrations measurements data

- Concentration of BTEX resulting from the extensive literature review carried are significantly below the Reference Exposure Limit (REL) for Acute affects. In only very few cases the concentration of benzene are higher than the relevant REL for chronic effects confirming that the importance of BTEX exposure arises due to the prolonged exposure to benzene.

- Internal exposure to benzene toxic metabolites is higher to children, due to the relatively higher bodyweight normalized daily dose

- BTEX PBPK/D model was validated against independent biomonitoring data set. Results showed that the PBPK/D model provides accurate predictions of both the interaction mechanism among the constituents of the mixture and of the benzene metabolic chain.

- At the levels of environmental concentrations met in EU indoor locations, no mixture interaction at the metabolism level is manifested; thus, co-exposure to BTEX does not pose any reason for additional concern should these contaminants be assessed as individual substances

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Appendix 1 - Overview of the concentrations (µg/m^3) of benzene observed in indoor environments within the European Union

Table 12. Overview of the concentrations (μg/m^3) of benzene observed in indoor environments within the European Union

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location (other information)	Samples
1.57		2.23		14.11		1.94	Homes no smoke	(Edwards, et al. 2001)	Helsinki	
				5.0	4.2		Homes + smoke	-‖-	Helsinki	
		1.6	1.3	7.7			Homes	(Ullrich, et al. 2002)	Germany	
		10.1				7.8	-‖-	(Hanninen, et al. 2002)	Athens	42
		2.7				1.7	-‖-	-‖-	Basel	47
		2.2				1.9	-‖-	-‖-	Helsinki	188
		17.0				23.4	-‖-	-‖-	Milan	41
		3.6				3.4	-‖-	-‖-	Oxford	40
		8.0				4.6	-‖-	-‖-	Prague	46
		44					AOSC Stadium (seats)	(Stathopoulou, et al. 2008)	Athens	
		2.2					Homes	(Stranger, et al. 2007)	Antwerp, Belgium	18
		0.98					Schools	-‖-	-‖-	27
		nd					Apartment 0 month old	(Jarnstrom, et al. 2006)	Finland	14
		nd					Apartment 6 months old	-‖-	-‖-	-‖-
		3					Apartment 12 months old	-‖-	-‖-	-‖-
		14.6		109	1	20.9	Buildings	(Zuraimi, et al. 2006)	EU	
		3.2	2.3	3.3			Homes	(Schlink, et al. 2004)	Liepzig, Munchen, Koln	2103
		6.5					Library I	(Righi, et al. 2002)	Italy	
		12					Library II	-‖-	-‖-	
		11					Library III	-‖-	-‖-	
		39					Library IV	-‖-	-‖-	
				3			Home room 1	(Eberlein-König, et al. 2002)	Germany	11
				6			-‖- 2	-‖-	-‖-	-‖-
				3			-‖- 3	-‖-	-‖-	-‖-
				5			-‖- 4	-‖-	-‖-	-‖-
				10			-‖- 5	-‖-	-‖-	-‖-
				20			-‖- 6	-‖-	-‖-	-‖-
				2			-‖- 7	-‖-	-‖-	-‖-
				6			-‖- 8	-‖-	-‖-	-‖-
				1			-‖- 9	-‖-	-‖-	-‖-
				2			-‖- 10	-‖-	-‖-	-‖-
				22			-‖- 11	-‖-	-‖-	-‖-
				7			-‖- 12	-‖-	-‖-	-‖-
				2			-‖- 13	-‖-	-‖-	-‖-
		3.2	2.9	8.1	0.6	1.7	Schools near motorways	(Janssen, et al. 2001)	Netherlands	160
		2.9	2.5	4.8	2	0.7	schools near motorways	(Janssen, et al. 2001)	Netherlands	24
		1.975				2.071	Homes near motorway	(Kingham, et al. 2000)	Huddersfield, UK	11
		1.152				0.795	Homes far from motorway	-‖-	-‖-	-‖-
		7.7	7.3	18.8	2.2		High traffic homes	(Fischer, et al. 2000)	Amsterdam	13

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location (other information)	Samples
		5.7	6.3	10.5	1.5		Low traffic homes	-‖-	-‖-	-‖-
		7.4		17.1	4.9		Public buildings	(Kotzias, et al. 2005)	Catania (October)	3
		3.9		4.8	2.8		-‖-	-‖-	Catania (May)	3
		10.9		13.3	7.3		-‖-	-‖-	Athens (December)	3
		8.8		12.9	5.6		-‖-	-‖-	Athens (October)	3
		4.3		5.4	3.1		-‖-	-‖-	Nijmegen (March)	2
		2.4		2.5	2.3		-‖-	-‖-	Nijmegen (August)	2
		3.5		6.2	1.8		-‖-	-‖-	Arnhem (March)	2
		1.1		1.4	1.0		-‖-	-‖-	Arnhem (August)	2
		33.0		63.7	8.0		-‖-	-‖-	Thessaloniki (November)	3
		5.0		7.9	3.1		-‖-	-‖-	Thessaloniki (May)	3
		2.9		3.9	1.9		-‖-	-‖-	Leipzig (April)	3
		2.0		2.9	1.5		-‖-	-‖-	Leipzig (July)	3
		2.9		3.9	1.9		-‖-	-‖-	Brussels(September)	3
		2.13		2.4	1.9		-‖-	-‖-	Brussels (March)	3
				-			-‖-	-‖-	Nicosia (July)	3
		4.3		9.6	3.7		-‖-	-‖-	Nicosia (January)	3
				-			-‖-	-‖-	Milan (November)	3
		1.9		2.7	1.2		-‖-	-‖-	Budapest (May)	6
		0.94		1.3	0.7		-‖-	-‖-	Helsinki (August)	3
				2.9	1.8	2.18	-‖-	-‖-	Dublin (May)	4
		3.8		4.4	3.1		Schools/Kindergartens	-‖-	Catania (October)	3
		2.6		2.8	2.3		-‖-	-‖-	Catania (May)	3
		7.4		10.7	4.9		-‖-	-‖-	Athens (December)	3
		5.0		6.1	2.9		-‖-	-‖-	Athens (October)	3
		2.1					-‖-	-‖-	Nijmegen (March)	2
		0.9					-‖-	-‖-	Nijmegen (August)	2
		3					-‖-	-‖-	Arnhem	2

(March)

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location (other information)	Samples
		0.8					-‖-	-‖-	Arnhem (August)	2
		5.8		7.5	2.6		-‖-	-‖-	Thessaloniki (November)	3
		3.1		5.6	1.5		-‖-	-‖-	Thessaloniki (May)	3
		1.4		1.8	1.0		-‖-	-‖-	Leipzig (April)	3
		0.7		0.7	0.6		-‖-	-‖-	Leipzig (July)	3
				-			-‖-	-‖-	Brussels(September)	3
				-			-‖-	-‖-	Brussels (March)	3
		1.7		2.7	1.1		-‖-	-‖-	Nicosia (July)	3
		4.4		5.6	3.7		-‖-	-‖-	Nicosia (January)	3
		3.0		1.2	4.5		-‖-	-‖-	Milan (November)	3
		6.5		25.8	0.9		-‖-	-‖-	Budapest (May)	6
		0.93		1.1	0.8		-‖-	-‖-	Helsinki (August)	3
		1.85		2.6	1.3		-‖-	-‖-	Dublin (May)	4
		3.0					homes	(Brown, et al. 2002)	UK	876
		2.6					homes	(Brown, et al. 2002)	UK (spring)	
		1.2					homes	(Brown, et al. 2002)	UK (summer)	
		4.1					homes	(Brown, et al. 2002)	UK (autumn)	
		4.2					homes	(Brown, et al. 2002)	UK (winter)	
		4.3					homes	(Brown, et al. 2002)	UK (intergral garage)	
		2.5					homes	(Brown, et al. 2002)	UK (detached garage)	
		2.9					homes	(Brown, et al. 2002)	UK (no garage)	
		4.4					homes	(Brown, et al. 2002)	UK (regular smokers)	
		2.6					homes	(Brown, et al. 2002)	UK (no regular smokers)	
		2.4					homes	(Brown, et al. 2002)	UK (rural)	
		3.2					homes	(Brown, et al. 2002)	UK (suburban)	
		3.3					homes	(Brown, et al. 2002)	UK (urban)	
		4.9					homes	(Brown, et al. 2002)	UK (central urban)	
		3.53	3.28	8.28	0.89	1.56	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20
		3.86	3.39	12.62	1.33	2.33	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location (other information)	Samples
		4.27	3.63	14.08	1.43	2.49	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20
		2.5	2.17				-‖-	(Schneider, et al. 2001)	Erfurt (Germany)	204
			2.9				homes	(Schneider, et al. 2001)	Erfurt (Eastern Germany), winter	204
			0.9				homes	(Schneider, et al. 2001)	Erfurt (Eastern Germany), summer	204
		2.3	1.48				-‖-	(Schneider, et al. 2001)	Hamburg (Germany)	201
			2.5				homes	(Schneider, et al. 2001)	Hamburg (West Germany), winter	201
			1.2				homes	(Schneider, et al. 2001)	Hamburg (West Germany), summer	201
		1.72				0.06	car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		3				0.1	car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		5.4				0.1	car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		18.3				0.3	car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		16				0.7	car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		3.9				0.4	car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		40				4	car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		44				5	car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		6.1				0.7	car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		32				3	car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		16				3	car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		9					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		45					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		17					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		99					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		132					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		123					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		MQL (less than method quantitati on limit)					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		51					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		10					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		48					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		185					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location (other information)	Samples
		60					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		MQL (less than method quantitation limit)					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		82					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		20					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		MQL (less than method quantitation limit)					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		63					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		13					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		MQL (less than method quantitation limit)					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		69					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		28					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		989					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		1156					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		1200					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		976					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		946					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		943					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		21					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		123					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		75					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		27					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		93					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		37					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
2.6	2.2	3.6					Houses	(Lai, et al. 2004)	Oxford, UK	
		<LD					Airport terminal	(Tumbiolo, et al. 2004)	France, south-east	
		3.9					home, Flat bedroom	(Tumbiolo, et al. 2004)	Turin	
		0.17					Train with a/c	(Tumbiolo, et al. 2005)	Allessadria	
		3.9					home, Bedroom 1	(Tumbiolo, et al. 2005)	Torino	
		5.9					home, Kitchen	(Tumbiolo, et al. 2005)	Torino	
		3.3					home, Living room	(Tumbiolo, et al. 2005)	Torino	

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location (other information)	Samples
		2.1					home, Bedroom 2	(Tumbiolo, et al. 2005)	Torino	
		2.6					home, Bathroom	(Tumbiolo, et al. 2005)	Torino	
		1.9					home, Bedroom 1	(Tumbiolo, et al. 2005)	Torino	
		2.7					home, Kitchen	(Tumbiolo, et al. 2005)	Torino	
		2.7					home, Living room	(Tumbiolo, et al. 2005)	Torino	
		1.2					home, Bedroom 2	(Tumbiolo, et al. 2005)	Torino	
		3.4					home, Bathroom	(Tumbiolo, et al. 2005)	Torino	
		13.4					home, Living room, during renovation	(Tumbiolo, et al. 2005)	Torino	
		10.5					home, kitchen, during renovation	(Tumbiolo, et al. 2005)	Torino	
		12.4					home,bedroom, during renovation	(Tumbiolo, et al. 2005)	Torino	
		0.48					home, Living room, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino	
		0.28					home, kitchen, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino	
		0.68					home, bedroom, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino	
		1.06					Train no a/c	(Tumbiolo, et al. 2005)	Torino	
		0.2			0	0.2	University Libraries	(Allou, et al. 2008)	Strasbourg	20
		1.65	1.39	5.49	0.42	1.11	bars+restaurants+smoke	(Alonso, et al. 2010)	Girona cities (NE Spain) (fall)	21
		3.7	2.3	11.9	0.4	3.1	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (Sept-March)	41 bars+restaurants
		0.7	0.6	2		0.5	bars+restaurants (non smoking)	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (Sept-March)	15 bars+restaurants
		5.79	5.71	11.86	1.75	3.04	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (winter)	20
		9.7					Printing shop	(Caselli, et al. 2009)	Bari	
		2.8					Printing shop	(Sun, et al. 2004)	Bari	
		5					Printing shop	(Sun, et al. 2004)	Bari	
		6.8					Printing shop	(Sun, et al. 2004)	Bari	
		10.2		13.35	6.03	6.5	homes	(Chatzis, et al. 2005)	Athens, Greece	
		1.9		18.62	0.32	2.41	home	(Delgado-Saborit, et al. 2011)	London+East Midlands+rural S.Wales, UK	155
		1.55					Labolatories	(Elke, et al. 1998)	Dusseldorf	Germany
		1.63					Labolatories	(Elke, et al. 1998)	Dusseldorf	Germany
		<0.54					Labolatories	(Elke, et al. 1998)	Dusseldorf	Germany
		1.84					Labolatories	(Elke, et al. 1998)	Dusseldorf	Germany
		13.6					Train	(Elke, et al. 1998)	Dusseldorf	2
		19.7					Car	(Elke, et al. 1998)	Dusseldorf	2
		10.6					Homes	(Elke, et al. 1998)	Dusseldorf	2
1.4		2.7		88.7	0.52	6.4	homes	(Esplugues, et al. 2010)	Valencia + sur villages, Spain	352
			6.3	33	2		homes	(Field, et al. 2005)	Brussels	52 citizens
			3				office	(Mozaffarian, et al. 2011)	Brussels	18 offices

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location (other information)	Samples
			1.6				schools	(Mozaffarian, et al. 2011)	Brussels	4 schools
			6				bars	(Mozaffarian, et al. 2011)	Brussels	4 bars
			10.8				shops	(Mozaffarian, et al. 2011)	Brussels	10 shops
			27.5				taxis	(Mozaffarian, et al. 2011)	Brussels	5
			1.6	5.5	1.1		homes	(Mozaffarian, et al. 2011)	Doublin	10 homes
			4.5				schools	(Mozaffarian, et al. 2011)	Doublin	10 schools
			1.6				offices	(Mozaffarian, et al. 2011)	Doublin	10 offices
			2				bars	(Mozaffarian, et al. 2011)	Doublin	9 bars
			3.5				homes	(Mozaffarian, et al. 2011)	Lisbon	18 homes
			4.2	9	1		schools	(Mozaffarian, et al. 2011)	Lisbon	9 schools
			1.6				shops	(Mozaffarian, et al. 2011)	Lisbon	9 shops
			4.4				bars	(Mozaffarian, et al. 2011)	Lisbon	8 bars
			5.9				offices	(Mozaffarian, et al. 2011)	Lisbon	10 offices
			5.7				metro stations	(Mozaffarian, et al. 2011)	Lisbon	5 metro stations
			9.2				buses	(Mozaffarian, et al. 2011)	Lisbon	4 buses
			7.9	24	3		homes	(Mozaffarian, et al. 2011)	Bucharest, Romania	30 homes
			4.6				schools	(Mozaffarian, et al. 2011)	Bucharest	1 school
			22.5				shops	(Mozaffarian, et al. 2011)	Bucharest	2 shops
			17.7				bars	(Mozaffarian, et al. 2011)	Bucharest	1 bar
			10.3				offices	(Mozaffarian, et al. 2011)	Bucharest	6 offices
			2.2	4.8	1.2		homes	(Mozaffarian, et al. 2011)	Ljubljana, Slovenia	21 homes
			2.5				schools	(Mozaffarian, et al. 2011)	Ljubljana	10 schools
			2.9				restaurants	(Mozaffarian, et al. 2011)	Ljubljana	5 restaurants
			3.6				offices	(Mozaffarian, et al. 2011)	Ljubljana	11 offices
			5.8				bars	(Mozaffarian, et al. 2011)	Ljubljana	5 bars
			3.8				shops	(Mozaffarian, et al. 2011)	Ljubljana	10 shops
			5.3	23	2.5		homes	(Mozaffarian, et al. 2011)	Madrid, Spain	13 homes
			6				schools	(Mozaffarian, et al. 2011)	Madrid	3 schools
			14.8				taxis	(Mozaffarian, et al. 2011)	Madrid	7 taxis
			7.9				offices	(Mozaffarian, et al. 2011)	Madrid	4 offices

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location (other information)	Samples
			19.4				bars	(Mozaffarian, et al. 2011)	Madrid	5 bars
			8.8				shops	(Mozaffarian, et al. 2011)	Madrid	4 shops
		5.9	5.7	9.6	3.3	2.4	Home I, near street	(Fondelli, et al. 2008)	Florence, Rifredi (winter)	11 apartments
		5.1	4.7	8.7	2.9	2	Home II, near courtyard	(Fondelli, et al. 2008)	Florence, Rifredi (winter)	11 apartments
		3.3	3.1	6	1.7	1.3	Home I, near street	(Fondelli, et al. 2008)	Florence, Rifredi (summer)	10 apartments
		2.7	2.5	6.2	1.6	1.3	Home II, near courtyard	(Fondelli, et al. 2008)	Florence, Rifredi (summer)	10 apartments
		5.5				2.07	Office	(Fuselli, et al. 2010)	Rome (2007)	
		5.1				2.01	Office	(van Dartel and Piersma 2011)	Rome (2008)	
		3.3				1.2	Office	(van Dartel and Piersma 2011)	Rome (2009)	
		1.6		14.5	0.4		homes	(Hulin, et al. 2010)	Clermont-Ferrand (summer)	27
		3.3		53.5	1.3		homes		Clermont-Ferrand (winter)	36
		0.8		9.8	0.3		homes		Clermont-Ferrand rural (summer)	49
		1.8		53.5	0.3		homes		Clermont-Ferrand urban+rural	112
0.48							Homes	(Ilgen, et al. 2001)	Hannover (Rural)	23
2.03							Homes	(Ilgen, et al. 2001)	Hannover (Rural)	96
2.06							Homes	(Ilgen, et al. 2001)	Hannover (Urban)	29
3.87							Homes	(Ilgen, et al. 2001)	Hannover (Urban)	44
		1.7					Homes	(Ilgen, et al. 2001)	Hannover (Rural)	58
		1.4					Homes	(Ilgen, et al. 2001)	Hannover (Rural)	57
		1.7					Homes	(Ilgen, et al. 2001)	Hannover (Rural)	52
		1.6					Homes	(Ilgen, et al. 2001)	Hannover (Rural)	34
		1.3					Homes	(Ilgen, et al. 2001)	Hannover (Rural)	12
		3.1					Homes	(Ilgen, et al. 2001)	Hannover (Urban)	51
		2.9					Homes	(Ilgen, et al. 2001)	Hannover (Urban)	50
		3.1					Homes	(Ilgen, et al. 2001)	Hannover (Urban)	53
		2.7					Homes	(Ilgen, et al. 2001)	Hannover (Urban)	10
		3					Homes	(Ilgen, et al. 2001)	Hannover (Urban)	11
1.27							Homes	(Ilgen, et al. 2001)	Hannover	61
1.76							Homes	(Ilgen, et al. 2001)	Hannover	99
2.5							Homes	(Ilgen, et al. 2001)	Hannover	38
3.22							Homes	(Ilgen, et al. 2001)	Hannover	101
		12.5					Homes	(Ilgen, et al. 2001)	Hannover	2
		20.1					Homes	(Ilgen, et al. 2001)	Hannover	2
		80.9					Homes	(Ilgen, et al. 2001)	Hannover	2
		1.4					Homes	(Ilgen, et al. 2001)	Hannover	2
		1.7					Homes	(Ilgen, et al. 2001)	Hannover	2
		1.2					Homes	(Ilgen, et al. 2001)	Hannover	2
		6.1					Homes	(Ilgen, et al. 2001)	Hannover	2
		not measured					Homes	(Ilgen, et al. 2001)	Hannover	2
		43.2					Homes	(Ilgen, et al. 2001)	Hannover	2

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location (other information)	Samples
1.53							Homes	(Ilgen, et al. 2001)	Hannover	22
1.31							Homes	(Ilgen, et al. 2001)	Hannover	21
1.84		2.38		12.36	0.27	1.97	Homes	(Ilgen, et al. 2001)	Hannover	59
3.07		3.46		12.08	1.24	1.9	Homes	(Houston 2011)	Hannover	56
		9.1				6.2	homes, parent bedroom	(Kouniali, et al. 2003)	Rouen, France	
		10.9				7.2	homes, children bedroom	(Kouniali, et al. 2003)	Rouen, France	
		10.5				1.9	Day care center, A	(Kouniali, et al. 2003)	Rouen, France	8
		35.5				13.5	Day care center, B section 1	(Kouniali, et al. 2003)	Rouen, France	4
		11.1				6.9	Day care center, B section 2	(Kouniali, et al. 2003)	Rouen, France	4
		9.1				5	Day care center, B section 3	(Kouniali, et al. 2003)	Rouen, France	4
		7.9				3.4	Day care center, B section C	(Kouniali, et al. 2003)	Rouen, France	5
		6.2		7.4	1.8		Police Station	(Manini, et al. 2008)	Parma, Italy	62
2	1.6		2.1	4.4	0.5		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
1.4	1.5		1.4	3.7	0.5		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
2.1	1.6		2.1	4.5	0.9		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
1.6	1.5		1.6	3.9	0.9		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
				4	0.2		Office buidings	(Salonen, et al. 2009)	Finland	520
		3.5		3.8	3.1	0.2	Dental hospital	(Santarsiero, et al. 2011)	Rome	
		3.2		3.8	2.1	0.5	Dental hospital	(Santarsiero, et al. 2011)	Rome	
		17.6		38.6	3.6	10.4	office, Smokers	(Liu, et al. 2011)	Athens, Aghia Paraskevi (July)	
		15.3		18.3	12.4	4.17	office NON Smokers'	(Liu, et al. 2011)	Athens, Aghia Paraskevi (July)	
		69.4		79.4	59	14.1	printery industry - Press section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, center (May)	
		12.1		12.4	11.8	0.42	printery industry - Bookbindery section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, center (May)	
		41.9		59.3	24.5	24.6	printery industry - Dispatch section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, center (May)	
		9.29		12	5.04	2.56	museum, glass, wood, carpet, metals, formalin, wood, semi open windows, no A/C	(Liu, et al. 2011)	Athens, Goudi (June-July)	20
		5.06		8.91	1.8	2.72	Home	(Saraga, et al. 2010)	Athens, Aghia Paraskevi (May)	
		6.85		12	4.52	3.01	Home+smoke	(Mahadevan, et al. 2011)	Athens, Aghia Paraskevi (May)	

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location (other information)	Samples
		2.03		22		2.19	homes	(Schlink, et al. 2010)	Leiptig, Germany	601
		6.21		7.82	4.92	0.9	coffee shop, smoking allowed	(Sousa, et al. 2011)	N. Portugal (April to July)	8
		4.09		5.6	2.03	1.45	coffee shop, near crossroad, doors open, no smoking	(Aardema and MacGregor 2002)	N. Portugal (February)	6
		6.1					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		5.5					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		2.2					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		2.5					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		1.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		1.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		2.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		4.2					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		4.8					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		3.7					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
3.3		3.6		6.1	1.9	1.6	Restaurant	(Vainiotalo, et al. 2008)	Helsinki	20
		2.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		3.7					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		2.1					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		1.4					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		1.3					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		1.7					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		1.2					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		0.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		1.2					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		3.8					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
1.8		2		3.8	0.9	1.1	Restaurant	(Vainiotalo, et al. 2008)	Helsinki	20
		13.9				13.8	homes	(Virtanen, et al. 2007)	Birminghamn	64
		16.3	11.4	63.7	4.2	15.3	homes+smoke	(Virtanen, et al. 2007)	Birminghamn	32
		11.5	6.6	51.7	3.4	11.8	homes+ no smoke	(Virtanen, et al. 2007)	Birminghamn	32
		5.9				2.3	offices	(Virtanen, et al. 2007)	Birminghamn	12
		22.7				4	restaurants	(Virtanen, et al. 2007)	Birminghamn	6
		31.7				33.5	pubs	(Virtanen, et al. 2007)	Birminghamn	6
		10.5				5.6	department stores	(Virtanen, et al. 2007)	Birminghamn	8
		15.5				9.1	cinemas	(Virtanen, et al. 2007)	Birminghamn	6
		6.8				1.2	perfume shops	(Virtanen, et al. 2007)	Birminghamn	3
		8.8				2.5	libraries	(Virtanen, et al. 2007)	Birminghamn	6
		4.2				1.6	labs	(Virtanen, et al. 2007)	Birminghamn	6
		46.5				37.7	train station (waiting area+platforms)??	(Virtanen, et al. 2007)	Birminghamn	12
		20				16.1	coach station (waiting area+platforms)??	(Virtanen, et al. 2007)	Birminghamn	12
		203.7				152.3	cars	(Virtanen, et al. 2007)	Birminghamn	36
		24.3				35.8	trains	(Virtanen, et al. 2007)	Birminghamn	18
		20.2				7.8	buses	(Virtanen, et al. 2007)	Birminghamn	18
		<0.1		<0.1	<0.1		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	34

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location (other information)	Samples
		<0.5		<0.5	<0.5		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	34
		47.1		68.7	39.6	14.2	home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	30
		81.6		404.4	24.4		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	30
		<0.1		<0.1	<0.1		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	40
		17.6		68.2	1.8		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	40
		82.7		88.1	79.5	3.8	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	9
		6		9.6	1.4		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	9
		39.9		43.2	35.6	3.3	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	9
		23.5		25.9	20.9		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	9
		14.3		22.4	10.7	8.2	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	60
		6.7		22.2	2.2		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	60
		25.6		31.4	23	3.1	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	30
		24.7		31.8	5.6		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	30

Table 13. Overview of the concentrations (μg/m^3) of toluene observed in indoor environments within the European Union

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		20.0					Indoor	(Kotzias, et al. 2005)	Helsinki	
		74.0					-‖-	-‖-	Prague	
		15.0	11	87.0			-‖-	(Ullrich, et al. 2002)	Germany	
		82.7				141	Homes	(Hanninen, et al. 2002)	Athens	42
		19.5				13.2	-‖-	-‖-	Basel	47
		20.1				24.4	-‖-	-‖-	Helsinki	188
		77.6				70.1	-‖-	-‖-	Milan	41
		23.7				41.5	-‖-	-‖-	Oxford	40
		86.2				95.7	-‖-	-‖-	Prague	46
		84					PFS Stadium (seats)	(Stathopoulou, et al. 2008)	Athens	
		84					AOSC Stadium (seats)	-‖-	-‖-	
		4.25					Homes	(Stranger, et al. 2007)	Antrewp, Belgium	18
		4.44					Schools	-‖-	-‖-	27
		35.1		158	2	40.6	Buildings	(Zuraimi, et al. 2006)	EU	
		29.5	18.3	43.6			Homes	(Schlink, et al. 2004)	Liepzig, Munchen, Koln	2103
		19					Library I	(Righi, et al. 2002)	Modena (Northen Italy)	
		-					Library II	-‖-	Modena (Northen Italy)	
		16					Library III	-‖-	Modena (Northen Italy)	
		46					Library IV	-‖-	Modena (Northen Italy)	
		23					Home room 1	(Eberlein-König, et al. 2002)	Germany	64
		121					-‖- 2	-‖-	-‖-	-‖-
		36					-‖- 3	-‖-	-‖-	-‖-
		52					-‖- 4	-‖-	-‖-	-‖-
		70					-‖- 5	-‖-	-‖-	-‖-
		96					-‖- 6	-‖-	-‖-	-‖-
		7					-‖- 7	-‖-	-‖-	-‖-
		358					-‖- 8	-‖-	-‖-	-‖-
		7					-‖- 9	-‖-	-‖-	-‖-
		141					-‖- 10	-‖-	-‖-	-‖-
		100					-‖- 11	-‖-	-‖-	-‖-
		51					-‖- 12	-‖-	-‖-	-‖-
		167					-‖- 13	-‖-	-‖-	-‖-
		15.1		1783.5	0.3		homes	(Brown, et al. 2002)	UK	876
		11.1					homes	(Brown, et al. 2002)	UK	
		10.9					homes	(Brown, et al. 2002)	UK	

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		19					homes	(Brown, et al. 2002)	UK	
		17.8					homes	(Brown, et al. 2002)	UK	
		21.4					homes	(Brown, et al. 2002)	UK	
		11.7					homes	(Brown, et al. 2002)	UK	
		15.2					homes	(Brown, et al. 2002)	UK	
		17.6					homes	(Brown, et al. 2002)	UK	
		14.2					homes	(Brown, et al. 2002)	UK	
		53.2	37.3				homes	(Schneider, et al. 2001)	Erfurt (Germany)	204
			43.3				homes	(Schneider, et al. 2001)	Erfurt (Germany)	204
			27.1				homes	(Schneider, et al. 2001)	Erfurt (Germany)	204
		32.6	20.5				homes	(Schneider, et al. 2001)	Hamburg (Germany)	201
			33.8				homes	(Schneider, et al. 2001)	Hamburg (Germany)	201
			14.6				homes	(Schneider, et al. 2001)	Hamburg (Germany)	201
		20					Apartment 0 month old	(Järnström, et al. 2006)	Finland	14
		5					Apartment 6 month old	-‖-	-‖-	-‖-
		11					Apartment 12 month old	-‖-	-‖-	-‖-
		26.9				29.39	Public buildings	(Kotzias, et al. 2005)	Catania (October 2004)	9
		14.75				14.39	-‖-	-‖-	Catania (May 2004)	8
		46.73				31.51	-‖-	-‖-	Athens (December 2003)	6
		30.62				12.14	-‖-	-‖-	Athens (October 2005)	14
		5.63				4.01	-‖-	-‖-	Nijmegen (March 2004)	3
		6				2.52	-‖-	-‖-	Nijmegen (August 2006)	4
		7.25				3.89	Houses	-‖-	Nijmegen (August 2006)	2
		3.5				0.94	Public buildings	-‖-	Arnchem (March 2004)	5
		3.52				0.93	Public buildings	-‖-	Arnchem (August 2006)	5
		10.62				9.46	Houses	-‖-	Arnchem (August 2006)	5
		37				23.57	Public buildings	-‖-	Thessalonica (November 2004)	7
		15.16				7.88	Public buildings	-‖-	Thessalonica (May 2006)	7
		15.63				10.51	Houses	-‖-	Thessalonica (May 2006)	8

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		9.3				8.52	Public buildings	-‖-	Leipzig (April 2005)	10
		14.88				8.83	Houses	-‖-	Leipzig (April 2005)	8
		3.93				2.88	Public buildings	-‖-	Leipzig (July 2006)	9
		6.61			7.13		Houses	-‖-	Leipzig (July 2006)	7
		10.34				3.79	Public buildings	-‖-	Brussels (September 2004)	8
		10.24				5.91	Public buildings	-‖-	Brussels (March 2007)	8
		9.4				7.3	Houses	-‖-	Brussels (March 2007)	3
		7.47				1.47	Public buildings	-‖-	Nicosia (July 2004)	3
		19.58				11.23	Public buildings	-‖-	Nicosia (January 2007)	12
		36.39				56.75	Houses	-‖-	Nicosia (January 2007)	9
		10.04				5.42	Public buildings	-‖-	Milan (November 2002)	7
		5.03				2.14	Public buildings	-‖-	Budapest (May 2007)	12
		8.31				4.71	Houses	-‖-	Budapest (May 2007)	7
		4.25				2.89	Public buildings	-‖-	Helsinki (August 2007)	11
		8.88				7.32	Houses	-‖-	-‖-	12
		3.6				1.44	Public buildings	-‖-	Dublin (May 2007)	11
		6.06				2.01	Houses	-‖-	Dublin (May 2007)	7
		5					Museum geology department room UG03	(Schieweck, et al. 2005)	Hanover, Germany	
		7					Museum geology department room UG04	-‖-	-‖-	
		6					Museum zoology department room EG10	-‖-	-‖-	
		10					Museum zoology department room R323	-‖-	-‖-	
		10					Museum ethnology department room 114 storage case	-‖-	-‖-	
		12					Museum ethnology department room R121 drawer	-‖-	-‖-	
		13					Museum ethnology department room R117	-‖-	-‖-	
		6					Museum prehistory department room UG20.1	-‖-	-‖-	
		6					Museum prehistory department room R214	-‖-	-‖-	
		21					Museum art gallery	-‖-	-‖-	

department room
R42

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		145				10	cars	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		33				2	cars	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		58.4				0.6	cars	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		43				2	cars	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		10.6				0.3	cars	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		11.5				2	cars	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		103				7	cars	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		140				10	cars	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		81				6	cars	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		69				6	cars	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		13				1	cars	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		34					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		36					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		35					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		802					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		671					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		830					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		12					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		60					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		MQL (less than method quantitation limit)					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		256					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		377					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		443					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		84					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		152					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		117					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		89					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		112					Car park	(Esteve-Turrillas, et al.	Valencia,	

2009)	Spain

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		177					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		124					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		143					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		156					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		881					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		1117					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		909					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		713					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		981					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		700					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		68					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		82					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		55					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		65					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		73					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		40					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
12.1	3	23.7					Homes	(Lai, et al. 2004)	Oxford, UK	
		131.1 (out of calibration range)					Airport terminal	(Tumbiolo, et al. 2004)	France, south-east	
		10.6					home, Flat bedroom	(Tumbiolo, et al. 2004)	Turin. Italy	
		3.35					Train with a/c	(Tumbiolo, et al. 2005)	Allessadria, Italy	
		10.6					home, Bedroom 1	(Tumbiolo, et al. 2005)	Torino, Italy	
		22.5					home, Kitchen	(Tumbiolo, et al. 2005)	Torino, Italy	
		19.7					home, Living room	(Tumbiolo, et al. 2005)	Torino, Italy	
		13.3					home, Bedroom 2	(Tumbiolo, et al. 2005)	Torino, Italy	
		19.8					home, Bathroom	(Tumbiolo, et al. 2005)	Torino, Italy	
		6.6					home, Bedroom 1	(Tumbiolo, et al. 2005)	Torino, Italy	
		7.3					home, Kitchen	(Tumbiolo, et al. 2005)	Torino, Italy	
		14.4					home, Living room	(Tumbiolo, et al. 2005)	Torino, Italy	
		11.1					home, Bedroom 2	(Tumbiolo, et al. 2005)	Torino, Italy	
		11.2					home, Bathroom	(Tumbiolo, et al. 2005)	Torino, Italy	
		84.9					home, Living room, during renovation	(Tumbiolo, et al. 2005)	Torino, Italy	
		36.6					home, kitchen, during renovation	(Tumbiolo, et al. 2005)	Torino, Italy	
		72.3					home, bedroom,	(Tumbiolo, et al. 2005)	Torino, Italy	

during renovation

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		4.35					home, Living room, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino, Italy	
		5.66					home, kitchen, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino, Italy	
		28.5					home, bedroom, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino, Italy	
		11.8					Train no a/c	(Tumbiolo, et al. 2005)	Torino, Italy	
		3.8		11.5	2.4	2.6	University Libraries	(Allou, et al. 2008)	Strasbourg, France	20
		5.67	3.63	22.51	1.8	4.69	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (fall)	21
		12.3	6.3	67.1	1.8	14.4	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (Sept-March)	41 bars+restaurants
		42.9	2.1	7.6	0.8	2	bars+restaurants (non smoking)	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (Sept-March)	15 bars+restaurants
		19.29	14.53	67.12	2.38	17.79	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (winter)	20
			11.9	414.2	1.5		homes, Main dwellings	(Billionnet, et al. 2011)	Paris, mainland France	490
		776.5					Printing shop	(Sun, et al. 2004)	Bari, Italy	
		51.8					Printing shop	(Sun, et al. 2004)	Bari, Italy	
		54.4					Printing shop	(Sun, et al. 2004)	Bari, Italy	
		103.6					Printing shop	(Sun, et al. 2004)	Bari, Italy	
		17.53		177.8	0.65	24.8	home	(Delgado-Saborit, et al. 2011)	London+East Midlands+ rural S.Wales	
		17.53		177.8	0.65	24.8	home	(Delgado-Saborit, et al. 2011)	London+East Midlands+ rural S.Wales	
14.62		20.35		247.44		24.86	Homes	(Edwards, et al. 2001)	Helsinki. Finland	
		4.59					Labolatories	(Elke, et al. 1998)	Dusseldorf, Germany	
		5.36					Labolatories	(Elke, et al. 1998)	Dusseldorf, Germany	
		<0.87					Labolatories	(Elke, et al. 1998)	Dusseldorf, Germany	
		4.53					Labolatories	(Elke, et al. 1998)	Dusseldorf, Germany	
		54.5					Train	(Elke, et al. 1998)	Dusseldorf, Germany	2
		55.3					Car	(Elke, et al. 1998)	Dusseldorf, Germany	2
		20.6					Homes	(Elke, et al. 1998)	Dusseldorf, Germany	2
9.3		16.2		175.5	0.09	20.6	homes	(Esplugues, et al. 2010)	Valencia, Spain	352
		13.2				4.6	Dental hospital	(van Dartel and Piersma 2011)	Rome (2007)	
		13.7				5.04	Office	(van Dartel and Piersma 2011)	Rome (2008)	

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		11.3				2.9	Office	(van Dartel and Piersma 2011)	Rome (2009)	
		32.6		522.5	2.1		homes		Clermont-Ferrand (summer)	27
		23.8		167.4	7.8		homes		Clermont-Ferrand (winter)	36
		12.2		253.7	2.6		homes		Clermont-Ferrand rural (summer)	49
		20.2		522.5	2.1		homes		Clermont-Ferrand urban+rural (winter+summer)	112
15.96							Homes	(Ilgen, et al. 2001)	Hannover	23
20.82							Homes	(Ilgen, et al. 2001)	Hannover	96
14.66							Homes	(Ilgen, et al. 2001)	Hannover	29
24.43							Homes	(Ilgen, et al. 2001)	Hannover	44
		23.3					Homes	(Ilgen, et al. 2001)	Hannover	58
		12.9					Homes	(Ilgen, et al. 2001)	Hannover	57
		19.1					Homes	(Ilgen, et al. 2001)	Hannover	52
		15.5					Homes	(Ilgen, et al. 2001)	Hannover	34
		19.5					Homes	(Ilgen, et al. 2001)	Hannover	12
		24.7					Homes	(Ilgen, et al. 2001)	Hannover	51
		19.1					Homes	(Ilgen, et al. 2001)	Hannover	50
		20.9					Homes	(Ilgen, et al. 2001)	Hannover	53
		21					Homes	(Ilgen, et al. 2001)	Hannover	10
		26.7					Homes	(Ilgen, et al. 2001)	Hannover	11
13.63							Homes	(Ilgen, et al. 2001)	Hannover	61
20.19							Homes	(Ilgen, et al. 2001)	Hannover	98
16.67							Homes	(Ilgen, et al. 2001)	Hannover	40
23.8							Homes	(Ilgen, et al. 2001)	Hannover	101
		57.2					Homes	(Ilgen, et al. 2001)	Hannover	2
		70.8					Homes	(Ilgen, et al. 2001)	Hannover	2
		318.7					Homes	(Ilgen, et al. 2001)	Hannover	2
		23.8					Homes	(Ilgen, et al. 2001)	Hannover	2
		9.7					Homes	(Ilgen, et al. 2001)	Hannover	2
		3.3					Homes	(Ilgen, et al. 2001)	Hannover	2
		24.6					Homes	(Ilgen, et al. 2001)	Hannover	2
		not measured					Homes	(Ilgen, et al. 2001)	Hannover	2
		102.9					Homes	(Ilgen, et al. 2001)	Hannover	2
11.5							Homes	(Ilgen, et al. 2001)	Hannover	22
21.52							Homes	(Ilgen, et al. 2001)	Hannover	21
19.72		30.82		509.12	4.49	65.11	Homes	(Houston 2011)	Hannover	59
21.75		25.28		79.12	6.08	14.23	Homes	(Houston 2011)	Hannover	56
		3.2		8	3.1		Police Station	(Manini, et al. 2008)	Parma, Italy	62
7.3	1.8		8	18.4	1.7		Child Day Care Centers	(Virtanen, et al. 2007)	Paris, France	28
6	1.5		5.5	25.5	3.3		Child Day Care Centers	(Virtanen, et al. 2007)	Paris, France	28

7.1	1.9		7.9	17.8	2		Child Day Care Centers	(Virtanen, et al. 2007)	Paris, France	28
G. mean	**GSD**	**Mean**	**Median**	**Max**	**Min**	**SD**	**Environment**	**Source**	**Location**	**Samples**
7.1	1.7		6.4	26.4	3		Child Day Care Centers	(Virtanen, et al. 2007)	Paris, France	28
		6.5		190	0.9		Office buidings	(Παφίτης 2010)	Helsinki, Finland	520
		5.6		6.4	4.8	0.5	Dental hospital	(Santarsiero, et al. 2011)	Rome, Italy	12
		5.5		6.5	4.8	0.6	Dental hospital	(Santarsiero, et al. 2011)	Rome, Italy	12
		53.7		84.1	3.5	24.6	office Smokers'	(Liu, et al. 2011)	Athens, Aghia Paraskevi (July), Greece	
		90.2		108	72.3	25.3	office NON Smokers'	(Liu, et al. 2011)	Athens, Aghia Paraskevi (July), Greece	
		149		165	132	23.3	printery industry - Press section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, center (May), Greece	
		147		225	68.1	111	printery industry - Bookbindery section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, center (May), Greece	
		155		160	151	6.72	printery industry - Dispatch section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, center (May), Greece	
		42.9		65.1	29.3	12.1	museum (glass, wood, carpet, metals, formalin, wood) semi open windows, no A/C	(Liu, et al. 2011)	Athens, Goudi (June-July), Greece	20
		18.6		36.4	3.91	12.5	Home	Saraga-Batzis et al 2010	Athens, Aghia Paraskevi (May), Greece	
		23.3		57.9	10.8	16.9	Home+smoke	(Mahadevan, et al. 2011)	Athens, Aghia Paraskevi (May), Greece	
		26.78		465.3		34.19	homes	(Δασκάλου 2008)	Leiptig, Germany	601
		46.97	46.48	88.19	15.71	20.2	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20
		50.13	52.51	96.62	18.83	19.82	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20
		53.96	55.52	103.78	17.99	22.7	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20
		4.25					Homes	(Stranger, et al. 2007)	Antwerp, Belgium	
		4.44					Schools	(Stranger, et al. 2007)	Antwerp, Belgium	
		3					beauty salon room 1	(Tsigonia, et al. 2010)	Athens, Greece	

		67					beauty salon room 2	(E.C. 2008)	Athens, Greece	
G. mean	**GSD**	**Mean**	**Median**	**Max**	**Min**	**SD**	**Environment**	**Source**	**Location**	**Samples**
		10					beauty salon room 3	(E.C. 2008)	Athens, Greece	
		40.6					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		28.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		3.1					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		8					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		4.4					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		6.3					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		9.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		11.5					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		18.3					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		11					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
10.6		14.2		40.6	3.1	12	Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	20
		42					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		25.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		3					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		4.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		1.7					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		5.2					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		3.8					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		1.3					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		2					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	
5.1		9.9		42	1.3	13.4	Restaurant	(Vainiotalo, et al. 2008)	Helsinki, Finland	20
		38.4				21.7	homes	(Virtanen, et al. 2007)	Birminghamn , UK	64
		29.2	28.4	78.2	9.6	17.4	homes+smoke	(Virtanen, et al. 2007)	Birminghamn , UK	32
		47.6	45.5	99.3	8.8	22	homes+ no smoke	(Virtanen, et al. 2007)	Birminghamn , UK	32
		22				14.4	offices	(Virtanen, et al. 2007)	Birminghamn , UK	12
		57				20.2	restaurants	(Virtanen, et al. 2007)	Birminghamn , UK	6
		75.4				79.7	pubs	(Virtanen, et al. 2007)	Birminghamn , UK	6

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		56.7				29.2	department stores	(Virtanen, et al. 2007)	Birminghamn , UK	8
		43.6				28.3	cinemas	(Virtanen, et al. 2007)	Birminghamn , UK	6
		43.8				26.7	perfume shops	(Virtanen, et al. 2007)	Birminghamn , UK	3
		21.2				9.7	libraries	(Virtanen, et al. 2007)	Birminghamn , UK	6
		8.3				3.1	labs	(Virtanen, et al. 2007)	Birminghamn , UK	6
		135.3				117.1	train station (waiting area+platforms)??	(Virtanen, et al. 2007)	Birminghamn , UK	12
		47.3				33.8	coach station (waiting area+platforms)??	(Virtanen, et al. 2007)	Birminghamn , UK	12
		494.0				283.6	cars	(Virtanen, et al. 2007)	Birminghamn , UK	36
		64.9				119.7	trains	(Virtanen, et al. 2007)	Birminghamn , UK	18
		69.3				30.9	buses	(Virtanen, et al. 2007)	Birminghamn , UK	18
		130.4		149.7	106.3	20.3	home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	34
		53.7		513.8	5		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	34
		95.8		102.4	87.5	6.7	home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	30
		57		188.2	10.4		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	30
		148.8		186.7	112.7	34.2	home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	40
		55.4		97.3	4.9		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	40
		42.4		48.2	36.9	5.5	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	9
		18.8		36.8	13		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	9
		61.3		104.1	28.4	33.9	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	9
		14.2		19.9	12.2		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	9
		73.4		90.1	73.2	6.5	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	60
		20.1		32.3	9.6		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	60
		16.2		16.8	15.8	0.4	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	30
		29.7		72.7	10.3		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	30

Note: -‖- means the same as above, gap means there is no information; Shadowed lines indicate studies with at least 40 samples

Table 14. Overview of the concentrations (µg/ m³) of ethylbenzene observed in indoor environments within the European Union

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		0.3						(Kliucininkas, et al. 2011)	Kaunas	
			2.2	85.3	<LD		Dwellings	(Billionnet, et al. 2011)	Paris	490
		2.3		40.9	0.03	4.3	homes	(Esplugues, et al. 2010)	Valencia, Spain	352
		2.3		9,3	0.9		Public building	(Missia, et al. 2010)	Athens	
		1.9					Schools	-‖-	Milan	
		1.4		24	1.1		Houses	-‖-	Copenhagen	
		2.5					Bedroom 1	(Tumbiolo, et al. 2005)	Torino, Italy	
		3.8					Kitchen	(Tumbiolo, et al. 2005)	Torino, Italy	
		3.2					Living room	(Tumbiolo, et al. 2005)	Torino, Italy	
		1.5					Bedroom 2	(Tumbiolo, et al. 2005)	Torino, Italy	
		2.9					Bathroom	(Tumbiolo, et al. 2005)	Torino, Italy	
		2.7					home, Bedroom 1	(Tumbiolo, et al. 2005)	Torino, Italy	
		3.1					home, Kitchen	(Tumbiolo, et al. 2005)	Torino, Italy	
		4					home, Living room	(Tumbiolo, et al. 2005)	Torino, Italy	
		2.1					home, Bedroom 2	(Tumbiolo, et al. 2005)	Torino, Italy	
		3.01					home, Bathroom	(Tumbiolo, et al. 2005)	Torino, Italy	
		6.47					home, Living room, during renovation	(Tumbiolo, et al. 2005)	Torino, Italy	
		4.82					home, kitchen, during renovation	(Tumbiolo, et al. 2005)	Torino, Italy	
		7.41					home, bedroom, during renovation	(Tumbiolo, et al. 2005)	Torino, Italy	
		0.86					home, Living room, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino, Italy	
		1.5					home, kitchen, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino, Italy	
		1.59					home, bedroom, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino, Italy	
		1.06					Train no a/c	(Tumbiolo, et al. 2005)	Torino, Italy	
		0.77					Train with a/c	(Tumbiolo, et al. 2005)	Allessadria, Italy	
		1.74		16.98	0.12	2.42	homes	(Delgado-Saborit, et al. 2011)	London+East Midlands+ rural S.Wales, UK	155
		0.5						(Pennequin-Cardinal, et al. 2005)	France	
		35.0					Airport terminal	(Tumbiolo, et	Turin, Italy	

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
								al. 2004)		
		2.5					Flat bedroom	-‖-	Italy	
		3					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		16					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		34					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		40					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		90					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		13					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		38					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		62					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		9					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		21					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		37					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		4					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		15					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		25					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		47					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		16					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		24					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		47					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		14					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		25					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		7					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		29					Diesel tank rooms	(Esteve-Turrillas, et	Valencia,	

al. 2009) Spain

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		40					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		67					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		595					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		636					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		662					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		635					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		766					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		521					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		1.7		6.1	0.73		Restaurant, Smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	20
		2.7					Restaurant, Smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		6.1					Restaurant, Smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		0.73					Restaurant, Smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		1.3					Restaurant, Smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		0.79					Restaurant, Smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		1.2					Restaurant, Smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		1.8					Restaurant, Smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		1.6					Restaurant, Smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		2.6					Restaurant, Smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		1.5					Restaurant, Smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		0.9		5.6	0.32		Restaurant, Non-smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	20
		2					Restaurant, Non-smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		5.6					Restaurant, Non-smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		0.74					Restaurant, Non-smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		0.87					Restaurant, Non-smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		0.44					Restaurant, Non-smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		1.1					Restaurant, Non-smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		0.73					Restaurant, Non-smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		0.32					Restaurant, Non-smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		0.52					Restaurant, Non-smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		1.3					Restaurant, Non-smoking areas	(Vainiotalo, et al. 2008)	Helsinki, Finland	
		3.2		4.5	2.5		Police station, Offices	(Manini, et al. 2008)	Parma, Italy	62
		0.8		2.2	0.4	0.5	University library	(Allou, et al. 2008)	Strasbourg	20
1.6	2.2	2.9					Houses	(Lai, et al. 2004)	Oxford, UK	110
		2.3				1.3	homes	(Virtanen, et al. 2007)	Birminghamn	
		1.9	1.5	5.9	0.6	1.2	homes+smoke	(Virtanen, et al. 2007)	Birminghamn	
		2.7	2.4	6.5	1.1	1.2	homes+ no smoke	(Virtanen, et al. 2007)	Birminghamn	
		2.4				1.3	offices	(Virtanen, et al. 2007)	Birminghamn	
		6.2				3	restaurants	(Virtanen, et al. 2007)	Birminghamn	
		7.3				11.4	pubs	(Virtanen, et al. 2007)	Birminghamn	
		3.4				2.4	department stores	(Virtanen, et al. 2007)	Birminghamn	
		5.9				5.6	cinemas	(Virtanen, et al. 2007)	Birminghamn	
		2.4				0.1	perfume shops	(Virtanen, et al. 2007)	Birminghamn	
		3.5				2.8	libraries	(Virtanen, et al. 2007)	Birminghamn	
		0.7				0.2	labs	(Virtanen, et al. 2007)	Birminghamn	
		7.4				7.6	train station (waiting area+platforms)??	(Virtanen, et al. 2007)	Birminghamn	
		3.8				1.3	coach station (waiting area+platforms)??	(Virtanen, et al. 2007)	Birminghamn	
		51.9				30.8	cars	(Virtanen, et al. 2007)	Birminghamn	
		5.6				8.8	trains	(Virtanen, et al. 2007)	Birminghamn	
		8				3.9	buses	(Virtanen, et al. 2007)	Birminghamn	
		2.89		18.98		2.78	Residential	(Edwards, et al. 2001)	Helsinki	
		7.7					Workplace	-‖-	-‖-	
		2.6					Houses	(Ilgen, et al. 2001)	Hannover	380
1.61							Homes	(Ilgen, et al. 2001)	Hannover	23
2.3							Homes	(Ilgen, et al. 2001)	Hannover	96
1.87							Homes	(Ilgen, et al. 2001)	Hannover	29
2.98							Homes	(Ilgen, et al. 2001)	Hannover	44
		2					Homes	(Ilgen, et al.	Hannover	58

	2001)

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		1.6					Homes	(Ilgen, et al. 2001)	Hannover	57
		2					Homes	(Ilgen, et al. 2001)	Hannover	52
		1.9					Homes	(Ilgen, et al. 2001)	Hannover	34
		2.1					Homes	(Ilgen, et al. 2001)	Hannover	12
		2.3					Homes	(Ilgen, et al. 2001)	Hannover	51
		2.2					Homes	(Ilgen, et al. 2001)	Hannover	50
		2.4					Homes	(Ilgen, et al. 2001)	Hannover	53
		2.5					Homes	(Ilgen, et al. 2001)	Hannover	10
		3					Homes	(Ilgen, et al. 2001)	Hannover	11
1.48							Homes	(Ilgen, et al. 2001)	Hannover	60
2.02							Homes	(Ilgen, et al. 2001)	Hannover	99
2.11							Homes	(Ilgen, et al. 2001)	Hannover	40
2.47							Homes	(Ilgen, et al. 2001)	Hannover	101
		6.8					Homes	(Ilgen, et al. 2001)	Hannover	2
		12.2					Homes	(Ilgen, et al. 2001)	Hannover	2
		48.8					Homes	(Ilgen, et al. 2001)	Hannover	2
		1.3					Homes	(Ilgen, et al. 2001)	Hannover	2
		2.3					Homes	(Ilgen, et al. 2001)	Hannover	2
		1.6					Homes	(Ilgen, et al. 2001)	Hannover	2
		2.6					Homes	(Ilgen, et al. 2001)	Hannover	2
		not measure d					Homes	(Ilgen, et al. 2001)	Hannover	2
		15.8					Homes	(Ilgen, et al. 2001)	Hannover	2
1.39							Homes	(Ilgen, et al. 2001)	Hannover	22
2.16							Homes	(Ilgen, et al. 2001)	Hannover	21
2.04		3.03		31.99	0.62	4.55	Homes	(Houston 2011)	Hannover	59
		2.66		12	1.02	1.75	Homes	(Houston 2011)	Hannover	56
		332.8		407.2	262.2	70.5	home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	34
		95.4		805.3	1.3		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	34
		1.7		2	1.4	2.6	home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	30

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		9.7		24.8	2		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	30
		26.4		33.5	22.9	4.3	home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	40
		8.3		31.3	0.5		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	40
		0.1		<0.1	<0.1		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	9
		1.8		2.8	1		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	9
		<0.1		<0.1	<0.1		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	9
		1.4		1.7	1.2		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	9
		14.3		20.4	13.2	4.7	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	60
		3		22.7	0.7		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	60
		23.4		26.2	21.3	1.8	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	30
		5.5		23.7	2.9		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk, Poland	30
		9.1					Residential	(Elke, et al. 1998)	Dusseldorf, Germany	
		9.9					Train	(Elke, et al. 1998)	Dusseldorf, Germany	
		22.4					Car	(Elke, et al. 1998)	Dusseldorf, Germany	
		3.69					Laboratory	(Elke, et al. 1998)	Dusseldorf, Germany	
		4.06					Laboratory	(Elke, et al. 1998)	Dusseldorf, Germany	
		<0.36					Laboratory	(Elke, et al. 1998)	Dusseldorf, Germany	
		2.94					Laboratory	(Elke, et al. 1998)	Dusseldorf, Germany	
		1.94	1.54	7.95	1.01	1.51	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (fall)	21
		2.3	1.5	10.9	0.5	2	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (Sept-March)	41 bars+restaurants
		1.1	1.1	2.5	0.2	0.6	bars+restaurants (non smoking)	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (Sept-March)	15 bars+restaurants
		2.77	2.12	10.85	0.54	2.41	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (winter)	20
				3			Home room 1	(Eberlein-König, et al. 2002)	Germany	6
				20			Home room 2	(Eberlein-König, et al. 2002)	Germany	6
				0			Home room 3	(Eberlein-König, et al. 2002)	Germany	6
				2			Home room 4	(Eberlein-König, et al. 2002)	Germany	6
				4			Home room 5	(Eberlein-König, et al. 2002)	Germany	6

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
				0			Home room 6	(Eberlein-König, et al. 2002)	Germany	6
				1			Home room 7	(Eberlein-König, et al. 2002)	Germany	6
				0			Home room 8	(Eberlein-König, et al. 2002)	Germany	6
				0			Home room 9	(Eberlein-König, et al. 2002)	Germany	6
				13			Home room 10	(Eberlein-König, et al. 2002)	Germany	6
				0			Home room 11	(Eberlein-König, et al. 2002)	Germany	6
				4			Home room 12	(Eberlein-König, et al. 2002)	Germany	6
				11			Home room 13	(Eberlein-König, et al. 2002)	Germany	6
		5.9					Printing shop	(Sun, et al. 2004)	Bari	
		2					Printing shop	(Sun, et al. 2004)	Bari	
		24					Printing shop	(Sun, et al. 2004)	Bari	
		37.4					Printing shop	(Sun, et al. 2004)	Bari	
2.17		2.89		18.98		2.78	Homes	(Edwards, et al. 2001)	Helsinki	
		1.2				0.1	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		7.2				0.9	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		5.6				0.1	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		5.9				0.1	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		1.92				0.08	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		0.55				0.03	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		16.3				0.7	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		45				2	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		6.6				0.4	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		7				1	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		2.9				0.1	Car, Vehicle interior	(Esteve-Turrillas, et	Valencia	

G. mean	GSD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
								al. 2007)		
6	2.4	9.1					homes	(Hanninen, et al. 2002)	Prague	
1.9		7.7					homes	(Hanninen, et al. 2002)	Athens	
7.5	2.3	10.7					homes	(Hanninen, et al. 2002)	Milan	43
2.1	1.8	2.7					homes	(Hanninen, et al. 2002)	Basel	
		1.4				0.49	Office	(van Dartel and Piersma 2011)	Rome	
		1.6				0.45	Office	(van Dartel and Piersma 2011)	Rome	
		1.1				0.43	Office	(van Dartel and Piersma 2011)	Rome	
		4.3		67.5	0.5		homes		Clermont-Ferrand (summer)	27
		4.1		64.6	1.3		homes		Clermont-Ferrand (winter)	36
		1.9		270.1	0.2		homes		Clermont-Ferrand rural (summer)	49
		2.9		270.1	0.2		homes		Clermont-Ferrand urban+rural (winter+summer)	112
1.3	1.8		1.3	5.7	0.4		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
1.3	1.8		1.3	5.4	0.6		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
1.4	1.9		1.1	4.9	0.5		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
1.4	1.9		1.3	7.4	0.6		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
				61	0.2		Office buidings	(Παφίτης 2010)	Finland	520
		2.2		2.6	1.8	0.3	Dental hospital	(Santarsiero, et al. 2011)	Rome	12
		2.1		2.7	1.7	0.3	Dental hospital	(Santarsiero, et al. 2011)	Rome	12
		2.23		29		2.95	homes	(Δασκάλου 2008)	Leiptig	601
		3.6	1.9	10.2			homes, Dwellings	(Schlink, et al. 2004)	Leipzig, M.unchen, and Koln	2103
		3.43	2.94	15.06	0.41	2.97	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20
		3.59	3.09	15.23	1.23	2.95	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20
		3.89	3.48	14.18	1.22	2.81	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20
		2.2	0.7				homes	(Schneider, et al. 2001)	Hamburg (West Germany)	201
		2.8	1.67				homes	(Schneider, et al. 2001)	Erfurt (Eastern	204

				Germany)	
0.62	Homes	(Stranger, et al. 2007)		Antwerp	18

Table 15. Overview of the concentrations (μg/ m^3) of xylenes observed in indoor environments within the European Union

	G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
m-+p-Xylenes			7.8					Indoor	(Hanninen, et al. 2002)	Helsinki	
-‖-			37.0					Indoor	-‖-	Milan	
-‖-			1.36					Homes	(Stranger, et al. 2007)	Antrewp, Belgium	18
-‖-			2.64					Schools	(Stranger, et al. 2007)	Antrewp, Belgium	27
-‖-			22.2		243.2	1	39.8	Buildings	(Zuraimi, et al. 2006)	EU	
-‖-			9.8	4.6	58.6			Homes	(Schlink, et al. 2004)	Liepzig, Munchen, Koln	2103
-‖-					7			Home room 1	(Eberlein-König, et al. 2002)	Germany	19
-‖-					48			Home room 2	-‖-	-‖-	-‖-
-‖-					3			Home room 3	-‖-	-‖-	-‖-
-‖-					8			Home room 4	-‖-	-‖-	-‖-
-‖-					10			Home room 5	-‖-	-‖-	-‖-
-‖-					9			Home room 6	-‖-	-‖-	-‖-
-‖-					3			Home room 7	-‖-	-‖-	-‖-
-‖-					6			Home room 8	-‖-	-‖-	-‖-
-‖-					2			Home room 9	-‖-	-‖-	-‖-
-‖-					8			Home room 10	-‖-	-‖-	-‖-
-‖-					0			Home room 11	-‖-	-‖-	-‖-
-‖-					15			Home room 12	-‖-	-‖-	-‖-
-‖-					39			Home room 13	-‖-	-‖-	-‖-
-‖-			12.01				3.83	Public buildings	(Kotzias, et al. 2005)	Catania (October 2004)	9
-‖-			14.46				24.57	-‖-	-‖-	Catania (May 2004)	8
-‖-			14.17				6.39	-‖-	-‖-	Athens (December 2003)	7
-‖-			15.88				8.74	-‖-	-‖-	Athens (October 2005)	14
-‖-			2.4				1.05	-‖-	-‖-	Nijmegen (March 2004)	3
-‖-			2.98				2.04	-‖-	-‖-	Nijmegen (August 2006)	4
-‖-			1.95				0.35	Houses	-‖-	Nijmegen (August 2006)	2
-‖-			1.94				0.52	Public buildings	-‖-	Arnchem (March 2004)	5
-‖-			1.62				0.23	Public buildings	-‖-	Arnchem (August 2006)	5

	G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
-‖-			2.44				1.4	Houses	-‖-	Arnchem (August 2006)	5
-‖-			23.11				17.39	Public buildings	-‖-	Thessalonica (November 2004)	7
-‖-			9.13				4.36	Public buildings	-‖-	Thessalonica (May 2006)	7
-‖-			6.65				1.83	Houses	-‖-	Thessalonica (May 2006)	8
-‖-			2.73				0.67	Public buildings	-‖-	Leipzig (April 2005)	10
-‖-			5.28				4.44	Houses	-‖-	Leipzig (April 2005)	8
-‖-			1.76				0.46	Public buildings	-‖-	Leipzig (July 2006)	9
-‖-			2.99				3.45	Houses	-‖-	Leipzig (July 2006)	7
-‖-			3.55				0.82	Public buildings	-‖-	Brussels (September 2004)	8
-‖-			2.35				0.73	Public buildings	-‖-	Brussels (March 2007)	8
-‖-			2.53				0.81	Houses	-‖-	Brussels (March 2007)	3
-‖-			3.93				1.42	Public buildings	-‖-	Nicosia (July 2004)	3
-‖-			7.14				2.22	Public buildings	-‖-	Nicosia (January 2007)	12
-‖-			7.83				7.81	Houses	-‖-	Nicosia (January 2007)	9
-‖-			6.69				3.36	Public buildings	-‖-	Milan (November 2002)	7
-‖-			2.22				0.64	Public buildings	-‖-	Budapest (May 2007)	12
-‖-			3.17				1.11	Houses	-‖-	Budapest (May 2007)	7
-‖-			1.76				0.67	Public buildings	-‖-	Helsinki (August 2007)	11
-‖-			3.6				3.29	Houses	-‖-	-‖-	12
-‖-			2.5				0.86	Public buildings	-‖-	Dublin (May 2007)	11
-‖-			2.43				1.25	Houses	-‖-	Dublin (May 2007)	7
-‖-			2					Museum zoology department room EG10	(Schieweck, et al. 2005)	Hanover, Germany	
-‖-			4					Museum ethnology department room 114 storage case	-‖-	-‖-	
-‖-			2					Museum ethnology department room R121 drawer	-‖-	-‖-	
-‖-			4					Museum ethnology department room R117	-‖-	-‖-	
-‖-			28					Museum art gallery department room R42	-‖-	-‖-	

4.8	2.5	9	homes	(Lai, et al. 2004)	Oxford, UK

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		100.3 (out of calibration range)					Airport terminal	(Tumbiolo, et al. 2004)	France, south-east	
		10.9					Flat bedroom	(Tumbiolo, et al. 2004)	Turin, Italy	
		4.87					Train with a/c	(Tumbiolo, et al. 2005)	Allessadria, Italy	
		10.9					home, Bedroom 1	(Tumbiolo, et al. 2005)	Torino, Italy	
		15.4					home, Kitchen	(Tumbiolo, et al. 2005)	Torino, Italy	
		12.5					home, Living room	(Tumbiolo, et al. 2005)	Torino, Italy	
		5.6					home, Bedroom 2	(Tumbiolo, et al. 2005)	Torino, Italy	
		11.2					home, Bathroom	(Tumbiolo, et al. 2005)	Torino, Italy	
		7					home, Bedroom 1	(Tumbiolo, et al. 2005)	Torino, Italy	
		16.6					home, Kitchen	(Tumbiolo, et al. 2005)	Torino, Italy	
		10.4					home, Living room	(Tumbiolo, et al. 2005)	Torino, Italy	
		4.3					home, Bedroom 2	(Tumbiolo, et al. 2005)	Torino, Italy	
		10.8					home, Bathroom	(Tumbiolo, et al. 2005)	Torino, Italy	
		40.9					home, Living room, during renovation	(Tumbiolo, et al. 2005)	Torino, Italy	
		28.2					home, kitchen, during renovation	(Tumbiolo, et al. 2005)	Torino, Italy	
		43.3					home, bedroom, during renovation	(Tumbiolo, et al. 2005)	Torino, Italy	
		2.91					home, Living room, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino, Italy	
		5.68					home, kitchen, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino, Italy	
		5.5					home, bedroom, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino, Italy	
		3.49					Train no a/c	(Tumbiolo, et al. 2005)	Torino, Italy	
		1.9		4	0.9	1.2	University Libraries	(Allou, et al. 2008)	Strasbourg, France	20
		2.56	2.15	6.78	0.73	1.42	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities, Spain	21
		5.6	2.8	38.7	0.7	6.8	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities, Spain	41 bars+restaurants
		1.5	1.2	4.7	0.6	1	bars+restaurants (non smoking)	(Νικολοπούλου-Σταμάτη 2008)	Girona cities, Spain	15 bars+restaurants
		8.87	6.68	38.68	1.74	8.65	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities, Spain	20
			5.4	232.8	0.8		homes, Main dwellings	(Billionnet, et al. 2011)	Paris, mainland France	490

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
3.8				152.8	0.1		homes	(Brown, et al. 2002)	UK	796
2.9							homes	(Brown, et al. 2002)	UK	
2.3							homes	(Brown, et al. 2002)	UK	
5.3							homes	(Brown, et al. 2002)	UK	
4.5							homes	(Brown, et al. 2002)	UK	
5							homes	(Brown, et al. 2002)	UK	
2.9							homes	(Brown, et al. 2002)	UK	
4							homes	(Brown, et al. 2002)	UK	
3.3							homes	(Brown, et al. 2002)	UK	
3.8							homes	(Brown, et al. 2002)	UK	
4.3							homes	(Brown, et al. 2002)	UK	
5.6							homes	(Brown, et al. 2002)	UK	
6.13		7.84		62.48		7.1	Homes	(Edwards, et al. 2001)	Helsinki, Finland	
		51.6					Labolatories	(Elke, et al. 1998)	Düsseldorf, Germany	
		60.5					Labolatories	(Elke, et al. 1998)	Düsseldorf, Germany	
		<1.11					Labolatories	(Elke, et al. 1998)	Düsseldorf, Germany	
		22					Labolatories	(Elke, et al. 1998)	Düsseldorf, Germany	
		23.2					Train	(Elke, et al. 1998)	Düsseldorf, Germany	2
		55.4					Car	(Elke, et al. 1998)	Düsseldorf, Germany	2
		15					Homes	(Elke, et al. 1998)	Düsseldorf, Germany	2
1.9		3.5		73	0.35	6.3	homes	Esplugues et al (2010)	Valencia, Spain	352
		0.92				0.03	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		18.1				0.8	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		11.8				0.5	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		18.6				0.8	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		5.5				0.4	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		2.5				0.2	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		62				6	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		81				5	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		9.1				0.3	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		17				1	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		7				0.6	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia, Spain	
		11					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		11					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		13					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		159					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		186					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		110					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		10					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		27					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		10					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		143					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		182					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		77					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		55					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		138					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		57					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		50					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		86					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		36					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		32					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		63					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		25					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		1063					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		999					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		1067					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		1082					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		1039					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		1089					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		58					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		39					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		61					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		57					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		37					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		65					Car park	(Esteve-Turrillas, et al. 2009)	Valencia, Spain	
		7.8					Indoor	(Hanninen, et al. 2002)	Helsinki, Finland	
26.1	2.2	36.5					Indoor	(Hanninen, et al. 2002)	Milan, Italy	
14.2	2.4	21.5					home	(Hanninen, et al. 2002)	Prague, Czech	46
3		24					homes	(Hanninen, et al. 2002)	Athens, Greece	
6.2	1.8	7.9					home	(Hanninen, et al. 2002)	Basel, Switzerland	46
		2.2				0.5	Office	(van Dartel and Piersma 2011)	Rome, Italy	23
		2.1				0.84	Office	(van Dartel and Piersma 2011)	Rome, Italy	96
		1.6				0.74	Office	(van Dartel and Piersma	Rome, Italy	29

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
								2011)		
3.23							Homes	(Ilgen, et al. 2001)	Hannover, Germany	42
4.97							Homes	(Ilgen, et al. 2001)	Hannover, Germany	58
4.74							Homes	(Ilgen, et al. 2001)	Hannover, Germany	57
8.27							Homes	(Ilgen, et al. 2001)	Hannover, Germany	52
		4.1					Homes	(Ilgen, et al. 2001)	Hannover, Germany	34
		3.6					Homes	(Ilgen, et al. 2001)	Hannover, Germany	12
		4.4					Homes	(Ilgen, et al. 2001)	Hannover, Germany	51
		4.1					Homes	(Ilgen, et al. 2001)	Hannover, Germany	50
		4.4					Homes	(Ilgen, et al. 2001)	Hannover, Germany	53
		5.9					Homes	(Ilgen, et al. 2001)	Hannover, Germany	10
		5.5					Homes	(Ilgen, et al. 2001)	Hannover, Germany	11
		6.1					Homes	(Ilgen, et al. 2001)	Hannover, Germany	60
		6.5					Homes	(Ilgen, et al. 2001)	Hannover, Germany	10
		7.5					Homes	(Ilgen, et al. 2001)	Hannover, Germany	11
3.18							Homes	(Ilgen, et al. 2001)	Hannover, Germany	60
4.51							Homes	(Ilgen, et al. 2001)	Hannover, Germany	99
5.5							Homes	(Ilgen, et al. 2001)	Hannover, Germany	40
6.15							Homes	(Ilgen, et al. 2001)	Hannover, Germany	99
		21.9					Homes	(Ilgen, et al. 2001)	Hannover, Germany	2
		38.3					Homes	(Ilgen, et al. 2001)	Hannover, Germany	2
		181.5					Homes	(Ilgen, et al. 2001)	Hannover, Germany	2
		3.5					Homes	(Ilgen, et al. 2001)	Hannover, Germany	2
		6.6					Homes	(Ilgen, et al. 2001)	Hannover, Germany	2
		4.5					Homes	(Ilgen, et al. 2001)	Hannover, Germany	2
		6.7					Homes	(Ilgen, et al. 2001)	Hannover, Germany	2
		not measured					Homes	(Ilgen, et al. 2001)	Hannover, Germany	2
		48.5					Homes	(Ilgen, et al. 2001)	Hannover, Germany	2
2.68							Homes	(Ilgen, et al. 2001)	Hannover, Germany	22
5.49							Homes	(Ilgen, et al. 2001)	Hannover, Germany	21
4.47		7.15		70.88	1.34	10.91	Homes	(Houston 2011)	Hannover, Germany	59

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
5.99		7.11		41.83	2.7	6.17	Homes	(Houston 2011)	Hannover, Germany	56
3.9	1.9		3.9	21.7	1.1		Child Day Care Centers	(Virtanen, et al. 2007)	Paris, France	28
3.7	1.8		3.6	14.2	1.7		Child Day Care Centers	(Virtanen, et al. 2007)	Paris, France	28
4	2.1		3.2	17.9	1.2		Child Day Care Centers	(Virtanen, et al. 2007)	Paris, France	28
3.8	2		3.6	23	1.5		Child Day Care Centers	(Virtanen, et al. 2007)	Paris, France	28
		4.2		190	0.4		Office buidings	(Παφίτης 2010)	Helsinki, Finland	520
		183		303	20.6	83.3	office Smokers'	(Liu, et al. 2011)	Athens, Greece	
		241		276	206	49.4	office NON Smokers'	(Liu, et al. 2011)	Athens, Greece	
		59.9		83.9	36	34	printery industry - Press section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, Greece	
		21		21	21	0	printery industry - Bookbindery section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, Greece	
		57.5		81.2	33.7	33.6	printery industry - Dispatch section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, Greece	
		74		104	57.5	17	museum (glass, wood, carpet, metals, formalin, wood) semi open windows, no A/C	(Liu, et al. 2011)	Athens, Greece	20
		9.63		18.4	2.51	6.29	Home	(Mahadevan, et al. 2011)	Athens, Greece	
		8.14		18.2	4.49	4.96	Home+smoke	(Mahadevan, et al. 2011)	Athens, Greece	
		4.79		88.1		7.91	homes	(Δασκάλου 2008)	Leiptig, Germany	601
		7.76	6.83	30.28	1.64	5.9	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt, Germany	20
		8.28	7.22	30.83	3.63	5.82	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt, Germany	20
		9.12	7.91	33.99	3.83	6.59	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt, Germany	20
		7.3	2.92				homes	(Schneider, et al. 2001)	Hamburg, Germany	201
			6.2				homes	(Schneider, et al. 2001)	Hamburg, Germany	201
			1.6				homes	(Schneider, et al. 2001)	Hamburg, Germany	201
		6.5	4.17				homes	(Schneider, et al. 2001)	Erfurt, Germany	204
			6.1				homes	(Schneider, et al. 2001)	Erfurt, Germany	204
			2.1				homes	(Schneider, et al. 2001)	Erfurt, Germany	204

	G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
			7					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			16.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			2.6					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			3.8					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			2.3					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			3.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			5.4					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			4.5					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			7.7					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			4.7					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
	5		5.9		16.9	2.3	4.2	Restaurant	(Vainiotalo, et al. 2008)	Helsinki	20
			5.2					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			15.7					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			2.6					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			2.5					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			1.4					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			3.4					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			2.1					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			1					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			1.6					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
			4					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
	2.8		3.6		15.7	1	4.3	Restaurant	(Vainiotalo, et al. 2008)	Helsinki	20
M, p, o Xylenes			30.4				14.6	Homes	(Hanninen, et al. 2002)	Athens	42
-‖-			10.2				8.2	-‖-	-‖-	Basel	47
-‖-			10.1				7.5	-‖-	-‖-	Helsinki	188
-‖-			88.2				184.1	-‖-	-‖-	Milan	41
-‖-			12.5				21.7	-‖-	-‖-	Oxford	40
-‖-			22.2				12.2	-‖-	-‖-	Prague	46
-‖-			25					Library I	(Righi, et al. 2002)	Italy	
-‖-			30					Library II	-‖-	-‖-	
-‖-			14					Library III	-‖-	-‖-	
-‖-			25					Library IV	-‖-	-‖-	
			22.2				12.2	Homes	(Eberlein-König, et al. 2002)	Prague	46

	G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
			10.1				7.5	Homes	(Eberlein-König, et al. 2002)	Helsinki	188
			30.4				14.6	Homes	(Eberlein-König, et al. 2002)	Athens	42
			88.2				184.1	Homes	(Eberlein-König, et al. 2002)	Milan	41
			10.2				8.2	Homes	(Eberlein-König, et al. 2002)	Basel	47
			12.5				21.7	Homes	(Eberlein-König, et al. 2002)	Oxford	40
			11.6		198.6	1.9		homes		Clermont-Ferrand (summer)	27
			13.9		176.4	4.5		homes		Clermont-Ferrand (winter)	36
			8		782.3	1.2		homes		Clermont-Ferrand rural (summer)	49
			10.3		782.3	1.2		homes		Clermont-Ferrand urban+rural (winter+summer)	112
	3.94							Homes	(Ilgen, et al. 2001)	Hannover	23
	6.56							Homes	(Ilgen, et al. 2001)	Hannover	96
	6.32							Homes	(Ilgen, et al. 2001)	Hannover	29
	11.09							Homes	(Ilgen, et al. 2001)	Hannover	42
			5.4					Homes	(Ilgen, et al. 2001)	Hannover	58
			4.7					Homes	(Ilgen, et al. 2001)	Hannover	57
			5.7					Homes	(Ilgen, et al. 2001)	Hannover	52
			5.4					Homes	(Ilgen, et al. 2001)	Hannover	34
			5.7					Homes	(Ilgen, et al. 2001)	Hannover	12
			7.9					Homes	(Ilgen, et al. 2001)	Hannover	51
			7.4					Homes	(Ilgen, et al. 2001)	Hannover	50
			8.1					Homes	(Ilgen, et al. 2001)	Hannover	53
			8.9					Homes	(Ilgen, et al. 2001)	Hannover	10
			9.9					Homes	(Ilgen, et al. 2001)	Hannover	11
	4.13							Homes	(Ilgen, et al. 2001)	Hannover	60
	5.91							Homes	(Ilgen, et al. 2001)	Hannover	99
	7.31							Homes	(Ilgen, et al.	Hannover	40

	G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
									2001)		
	8.16							Homes	(Ilgen, et al. 2001)	Hannover	99
	3.62							Homes	(Ilgen, et al. 2001)	Hannover	22
	7.3							Homes	(Ilgen, et al. 2001)	Hannover	21
	5.85		9.29		87.79	1.84	13.74	Homes	(Houston 2011)	Hannover	59
	7.97		9.41		54.64	3.64	8	Homes	(Houston 2011)	Hannover	56
			12.1		17	10.3		Police Station	(Manini, et al. 2008)	Parma	62
			4.2		4.9	3.7	0.4	Dental hospital	(Santarsiero, et al. 2011)	Rome	12
			4		5	2.9	0.6	Dental hospital	(Santarsiero, et al. 2011)	Rome	12
			9.2					homes	(Schneider, et al. 2001)	Hamburg (West Germany)	201
			8.4					homes	(Schneider, et al. 2001)	Erfurt (Eastern Germany)	204
m-Xylenes			not detected					beauty salon room 1	(E.C. 2008)	Athens	
			10					beauty salon room 2	(E.C. 2008)	Athens	
			not detected					beauty salon room 3	(E.C. 2008)	Athens	
			13.5					Printing shop	(Sun, et al. 2004)	Bari	
			3.3					Printing shop	(Sun, et al. 2004)	Bari	
			15.6					Printing shop	(Sun, et al. 2004)	Bari	
			15.5					Printing shop	(Sun, et al. 2004)	Bari	
			4.14		38.02	0.19	6.05	home	(Delgado-Saborit, et al. 2011)	London+East Midlands+ rural S.Wales	155
			5.3				3.2	homes	(Virtanen, et al. 2007)	Birminghamn	64
			4.3	3.5	16.1	1.3	2.9	homes+smoke	(Virtanen, et al. 2007)	Birminghamn	32
			6.3	5.5	15.5	2.4	1.3	homes+ no smoke	(Virtanen, et al. 2007)	Birminghamn	32
			6				3.6	offices	(Virtanen, et al. 2007)	Birminghamn	12
			16.3				8.2	restaurants	(Virtanen, et al. 2007)	Birminghamn	6
			18.3				28.6	pubs	(Virtanen, et al. 2007)	Birminghamn	6
			8.9				6.4	department stores	(Virtanen, et al. 2007)	Birminghamn	8
			15.7				14.1	cinemas	(Virtanen, et al. 2007)	Birminghamn	6
			6				0.3	perfume shops	(Virtanen, et al. 2007)	Birminghamn	3
			9.2				8.2	libraries	(Virtanen, et al. 2007)	Birminghamn	6
			1.9				0.9	labs	(Virtanen, et al. 2007)	Birminghamn	6

	G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
			18.8				18.7	train station (waiting area+platforms)??	(Virtanen, et al. 2007)	Birminghamn	12
			10.1				3.7	coach station (waiting area+platforms)??	(Virtanen, et al. 2007)	Birminghamn	12
			127.2				76.8	cars	(Virtanen, et al. 2007)	Birminghamn	36
			13.2				20.4	trains	(Virtanen, et al. 2007)	Birminghamn	18
			20.3				10.2	buses	(Virtanen, et al. 2007)	Birminghamn	18
			438.9		535.8	356.3	82.3	home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	34
			339.2		2638.6	5.4		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	34
			16.5		20	14.3	2.5	home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	30
			23.7		60.9	5.8		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	30
			25.9		28.8	23.8	1.9	home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	40
			18.8		132.8	2.5		home, New Building - living room	(Zabiegala, et al. 1999)	Gdansk	40
			16.1		16.6	15.1	0.8	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	9
			6.3		9.2	4.7		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	9
			8.4		8.9	7.8	0.4	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	9
			4.9		6	4.1		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	9
			25		32.2	21	4.3	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	60
			14		37.7	2.5		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	60
			24.8		31.6	17.2	5.5	home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	30
			19.1		114.8	9.5		home, Old Building - living room	(Zabiegala, et al. 1999)	Gdansk	30
			57					PFS Stadium (seats)	(Stathopoulou, et al. 2008)	Athens	
-‖-			51					AOSC Stadium (seats)	-‖-	-‖-	
-‖-			72					Apartment 0 month old	(Järnström, et al. 2006)	Finland	14
-‖-			24					Apartment 6 month old	-‖-	-‖-	-‖-
-‖-			4					Apartment 12 month old	-‖-	-‖-	-‖-
o, p Xylenes			72					Apartment 0 month old	-‖-	Finland	14
-‖-			24					Apartment 6 month old	-‖-	-‖-	-‖-
-‖-			4					Apartment 12 month old	-‖-	-‖-	-‖-
o-Xylenes			0.68					Homes	(Stranger, et al. 2007)	Antrewp, Belgium	18
-‖-			0.88					Schools	-‖-	-‖-	27
-‖-			10.2		29.5	1	9.3	Buildings	(Zuraimi, et	EU	

al. 2006)

	G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
-‖-			2.7	1.4	7.8			Homes	(Schlink, et al. 2004)	Liepzig, Munchen, Koln	2103
-‖-					0			Home room 1	(Eberlein-König, et al. 2002)	Germany	6
-‖-					13			-‖- 2	-‖-	-‖-	-‖-
-‖-					nd			-‖- 3	-‖-	-‖-	-‖-
-‖-					2			-‖- 4	-‖-	-‖-	-‖-
-‖-					3			-‖- 5	-‖-	-‖-	-‖-
-‖-					nd			-‖- 6	-‖-	-‖-	-‖-
-‖-					nd			-‖- 7	-‖-	-‖-	-‖-
-‖-					nd			-‖- 8	-‖-	-‖-	-‖-
-‖-					nd			-‖- 9	-‖-	-‖-	-‖-
-‖-					2			-‖- 10	-‖-	-‖-	-‖-
-‖-					nd			-‖- 11	-‖-	-‖-	-‖-
-‖-					4			-‖- 12	-‖-	-‖-	-‖-
-‖-					11			-‖- 13	-‖-	-‖-	-‖-
-‖-			1.9	0.79				homes	(Schneider, et al. 2001)	Erfurt (Germany)	204
-‖-			1.9	1.2				homes	-‖-	Hamburg (Germany)	201
-‖-			4.17				1.35	Public buildings	(Kotzias, et al. 2005)	Catania (October 2004)	9
-‖-			4.74				7.09	Public buildings	-‖-	Catania (May 2004)	8
-‖-			4.4				2.24	Public buildings	-‖-	Athens (December 2003)	7
-‖-			5.44				2.66	Public buildings	-‖-	Athens (October 2005)	14
-‖-			1.33				0.72	Public buildings	-‖-	Nijmegen (March 2004)	3
-‖-			1.2				0.78	Public buildings	-‖-	Nijmegen (August 2006)	4
-‖-			0.9				0.57	Houses	-‖-	Nijmegen (August 2006)	2
-‖-			0.78				0.29	Public buildings	-‖-	Arnchem (March 2004)	5
-‖-			0.72				0.18	Public buildings	-‖-	Arnchem (August 2006)	5
-‖-			1.14				0.76	Houses	-‖-	Arnchem (August 2006)	5
-‖-			7.13				5.56	Public buildings	-‖-	Thessalonica (November 2004)	7
-‖-			2.67				1.77	Public buildings	-‖-	Thessalonica (May 2006)	7
-‖-			2.09				0.6	Houses	-‖-	Thessalonica (May 2006)	8

	G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
-‖-			0.89				0.23	Public buildings	-‖-	Leipzig (April 2005)	10
-‖-			1.89				1.75	Houses	-‖-	Leipzig (April 2005)	8
-‖-			0.74				0.21	Public buildings	-‖-	Leipzig (July 2006)	9
-‖-			0.96				1.2	Houses	-‖-	Leipzig (July 2006)	7
-‖-			1.29				0.36	Public buildings	-‖-	Brussels (September 2004)	8
-‖-			1.08				0.27	Public buildings	-‖-	Brussels (March 2007)	8
-‖-			1.4				0.44	Houses	-‖-	Brussels (March 2007)	3
-‖-			1.4				0.66	Public buildings	-‖-	Nicosia (July 2004)	3
-‖-			2.83				1.03	Public buildings	-‖-	Nicosia (January 2007)	12
-‖-			5.01				6.74	Houses	-‖-	Nicosia (January 2007)	9
-‖-			3.8				1.85	Public buildings	-‖-	Milan (November 2002)	7
-‖-			0.88				0.68	Public buildings	-‖-	Budapest (May 2007)	12
-‖-			0.97				0.46	Houses	-‖-	Budapest (May 2007)	7
-‖-			0.87				0.29	Public buildings	-‖-	Helsinki (August 2007)	11
-‖-			1.63				1.06	Houses	-‖-	-‖-	12
-‖-			1.3				0.37	Public buildings	-‖-	Dublin (May 2007)	11
-‖-			1.19				0.43	Houses	-‖-	Dublin (May 2007)	7
-‖-			10					Museum art gallery department room R42	(Schieweck, et al. 2005)	Hanover, Germany	
			43.6					Airport terminal	(Tumbiolo, et al. 2004)	France, south-east	
			4.1					home, Flat bedroom	(Tumbiolo, et al. 2004)	Turin	
			2.4					Train with a/c	(Tumbiolo, et al. 2005)	Allessadria	
			4.1					home, Bedroom 1	(Tumbiolo, et al. 2005)	Torino	
			5.4					home, Kitchen	(Tumbiolo, et al. 2005)	Torino	
			5.1					home, Living room	(Tumbiolo, et al. 2005)	Torino	
			1.4					home, Bedroom 2	(Tumbiolo, et al. 2005)	Torino	
			2.3					home, Bathroom	(Tumbiolo, et al. 2005)	Torino	
			3.9					home, Bedroom 1	(Tumbiolo, et al. 2005)	Torino	
			4.9					home, Kitchen	(Tumbiolo, et al. 2005)	Torino	
			3.8					home, Living room	(Tumbiolo, et	Torino	

al. 2005)

	G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
			2.4					home, Bedroom 2	(Tumbiolo, et al. 2005)	Torino	
			3.14					home, Bathroom	(Tumbiolo, et al. 2005)	Torino	
			13.3					home, Living room, during renovation	(Tumbiolo, et al. 2005)	Torino	
			9.14					home, kitchen, during renovation	(Tumbiolo, et al. 2005)	Torino	
			11.2					home, bedroom, during renovation	(Tumbiolo, et al. 2005)	Torino	
			0.66					home, Living room, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino	
			1.64					home, kitchen, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino	
			10.8					home, bedroom, after renovation (10 months)	(Tumbiolo, et al. 2005)	Torino	
			1.16					Train no a/c	(Tumbiolo, et al. 2005)	Torino	
			0.5		0.3	0.1	0.4	University Libraries	(Allou, et al. 2008)	Strasbourg	20
			1.39	1.19	4.1	0.34	0.8	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (fall)	21
			1.9	1.3	9.7	0.3	1.6	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (Sept-March)	41 bars+restaurants
			1	1	1.8	0.3	0.4	bars+restaurants (non smoking)	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (Sept-March)	15 bars+restaurants
			2.48	2.04	9.71	0.71	2.01	bars+restaurants+smoke	(Νικολοπούλου-Σταμάτη 2008)	Girona cities (NE Spain) (winter)	20
				2.2	112.3	<LD		homes, Main dwellings	(Billionnet, et al. 2011)	Paris, mainland France	490
			2.5					Printing shop	(Sun, et al. 2004)	Bari	
			1.4					Printing shop	(Sun, et al. 2004)	Bari	
			14.3					Printing shop	(Sun, et al. 2004)	Bari	
			12.1					Printing shop	(Sun, et al. 2004)	Bari	
			2.02		18.6	0.1	2.95	home	(Delgado-Saborit, et al. 2011)	London+East Midlands+ rural S.Wales	155
	1.88		2.46		23.9		2.6	Homes	(Edwards, et al. 2001)	Helsinki	
			3.42					Labolatories	(Elke, et al. 1998)	Dusseldorf	Laboratory 1
			3.66					Labolatories	(Elke, et al. 1998)	Dusseldorf	Laboratory 1
			<0.8					Labolatories	(Elke, et al. 1998)	Dusseldorf	Laboratory 2
			4.47					Labolatories	(Elke, et al. 1998)	Dusseldorf	Laboratory 2
			18.1					Train	(Elke, et al. 1998)	Dusseldorf	2

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		32.2					Car	(Elke, et al. 1998)	Dusseldorf	2
		11.4					Homes	(Elke, et al. 1998)	Dusseldorf	2
1.4		3.1		41	0.03	5.5	homes	(Esplugues, et al. 2010)	Valencia	352
		0.163				0.005	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		11.1				0.3	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		10.1				0.7	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		6.1				0.4	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		1.31				0.03	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		0.52				0.02	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		24				2	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		72				1	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		5.3				0.4	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		10.5				0.4	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		5.5				0.4	Car, Vehicle interior	(Esteve-Turrillas, et al. 2007)	Valencia	
		10					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		3					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		19					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		47					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		40					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		139					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		10					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia	
		8					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia	
		16					Car park/diesel tank	(Esteve-Turrillas, et al. 2009)	Valencia	

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		49					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia	
		48					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia	
		112					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia	
		31					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		53					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		120					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		22					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		22					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		52					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		17					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		16					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		39					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		326					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia	
		250					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia	
		309					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia	
		370					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia	
		332					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia	
		318					Diesel tank rooms	(Esteve-Turrillas, et al. 2009)	Valencia	
		53					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		12					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		23					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		52					Car park	(Esteve-Turrillas, et	Valencia	

al. 2009)

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		11					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
		25					Car park	(Esteve-Turrillas, et al. 2009)	Valencia	
1.7	2.3	2.4					1Houses	(Hanninen, et al. 2002)	Helsinki	177
4.8	2.3	7.1					homes	(Hanninen, et al. 2002)	Prague	
7.8	2.5	11.5					homes	(Hanninen, et al. 2002)	Milan	43
2.1	1.9	2.7					homes	(Hanninen, et al. 2002)	Basel	43
		1.6				0.57	Office	(van Dartel and Piersma 2011)	Rome (2007)	
		1.6				0.59	Office	(van Dartel and Piersma 2011)	Rome (2008)	
		1.2				0.44	Office	(van Dartel and Piersma 2011)	Rome (2009)	
0.68							Homes	(Ilgen, et al. 2001)	Hannover	23
1.57							Homes	(Ilgen, et al. 2001)	Hannover	96
1.56							Homes	(Ilgen, et al. 2001)	Hannover	29
2.78							Homes	(Ilgen, et al. 2001)	Hannover	43
		1.3					Homes	(Ilgen, et al. 2001)	Hannover	58
		1					Homes	(Ilgen, et al. 2001)	Hannover	57
		1.4					Homes	(Ilgen, et al. 2001)	Hannover	52
		1.3					Homes	(Ilgen, et al. 2001)	Hannover	34
		1.3					Homes	(Ilgen, et al. 2001)	Hannover	12
		1.9					Homes	(Ilgen, et al. 2001)	Hannover	51
		1.8					Homes	(Ilgen, et al. 2001)	Hannover	50
		2					Homes	(Ilgen, et al. 2001)	Hannover	53
		2.4					Homes	(Ilgen, et al. 2001)	Hannover	10
		2.4					Homes	(Ilgen, et al. 2001)	Hannover	11
0.91							Homes	(Ilgen, et al. 2001)	Hannover	60
1.38							Homes	(Ilgen, et al. 2001)	Hannover	99
1.8							Homes	(Ilgen, et al. 2001)	Hannover	40
2.08							Homes	(Ilgen, et al. 2001)	Hannover	100
		6.2					Homes	(Ilgen, et al. 2001)	Hannover	2

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		11					Homes	(Ilgen, et al. 2001)	Hannover	2
		46.5					Homes	(Ilgen, et al. 2001)	Hannover	2
		1.1					Homes	(Ilgen, et al. 2001)	Hannover	2
		1.9					Homes	(Ilgen, et al. 2001)	Hannover	2
		1.4					Homes	(Ilgen, et al. 2001)	Hannover	2
		2.2					Homes	(Ilgen, et al. 2001)	Hannover	2
		not measured					Homes	(Ilgen, et al. 2001)	Hannover	2
		13.4					Homes	(Ilgen, et al. 2001)	Hannover	2
0.93							Homes	(Ilgen, et al. 2001)	Hannover	22
1.8							Homes	(Ilgen, et al. 2001)	Hannover	21
1.37		2.14		16.91	0.31	2.96	Homes	(Houston 2011)	Hannover	59
1.97		2.3		12.81	0.94	1.85	Homes	(Houston 2011)	Hannover	56
		10.2		29.5	1	9.3	Office Buildings	(Zuraimi, et al. 2006)	EU	
1.4	1.9		1.4	6.4	0.4		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
1.3	1.8		1.3	5.6	0.4		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
1.4	2.1		1.1	6.4	0.4		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
1.3	2.1		1.2	9	0.5		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
				29	0.2		Office buidings	(Παφίτης 2010)	Finland	520
		46.5					Homes	(Ilgen, et al. 2001)	Hannover	23
		1.1					Homes	(Ilgen, et al. 2001)	Hannover	96
		1.9					Homes	(Ilgen, et al. 2001)	Hannover	29
		1.4					Homes	(Ilgen, et al. 2001)	Hannover	43
		2.2					Homes	(Ilgen, et al. 2001)	Hannover	58
		not measured					Homes	(Ilgen, et al. 2001)	Hannover	57
		13.4					Homes	(Ilgen, et al. 2001)	Hannover	52
0.93							Homes	(Ilgen, et al. 2001)	Hannover	34
1.8							Homes	(Ilgen, et al. 2001)	Hannover	12
1.37		2.14		16.91	0.31	2.96	Homes	(Houston 2011)	Hannover	51
1.97		2.3		12.81	0.94	1.85	Homes	(Houston 2011)	Hannover	50
1.4	1.9		1.4	6.4	0.4		Child Day Care	(Virtanen, et	Paris	28

							Centers	al. 2007)		

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
1.3	1.8		1.3	5.6	0.4		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
1.4	2.1		1.1	6.4	0.4		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
1.3	2.1		1.2	9	0.5		Child Day Care Centers	(Virtanen, et al. 2007)	Paris	28
		118		204	5.7	64.6	office Smokers'	(Liu, et al. 2011)	Athens, Aghia Paraskevi (July)	520
		174		196	152	31.4	office NON Smokers'	(Liu, et al. 2011)	Athens, Aghia Paraskevi (July)	
		16.1		19.4	13	34	printery industry - Press section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, center (May)	
		9		9.9	8.1	1.27	printery industry - Bookbindery section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, center (May)	
		17.3		20.9	13.6	5.16	printery industry - Dispatch section, urban area with intensevehicular circulation, appr. 100 yr,	(Liu, et al. 2011)	Athens, center (May)	
		15.5		18.3	10.7	2.93	museum (glass, wood, carpet, metals, formalin, wood) semi open windows, no A/C	(Liu, et al. 2011)	Athens, Goudi (June-July)	20
		3.56		6.93	1.36	2.18	Home	(Mahadevan, et al. 2011)	Athens, Aghia Paraskevi (May)	
		4.25		7.65	2.68	1.71	Home+smoke	(Mahadevan, et al. 2011)	Athens, Aghia Paraskevi (May)	
		1.49		25		2.37	homes	(Δασκάλου 2008)	Leiptig	601
		2.7	2.27	11.62	0.77	2.28	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20
		2.84	2.21	11.32	1.04	2.27	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20
		3.07	2.51	10.22	1.2	2.08	Homes, Living room	(Tunggal and Indonesia. 2009)	Erfurt (Eastern Germany)	20
		2.1					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		7					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		0.83					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		1.1					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		0.73					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		1.4					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		1.4					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		1.1					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		1.9					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		1.1					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
1.5		1.9		7	0.73	1.9	Restaurant	(Vainiotalo, et al. 2008)	Helsinki	20
		1.8					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		6.6					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		0.85					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		0.78					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		0.55					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		1.3					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		0.69					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		0.42					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		0.6					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
		0.96					Restaurant	(Vainiotalo, et al. 2008)	Helsinki	
0.99		1.5		6.6	0.42	1.9	Restaurant	(Vainiotalo, et al. 2008)	Helsinki	20
		1.9				1.3	homes	(Virtanen, et al. 2007)	Birminghamn	64
		1.4	1.2	6.3	0.4	1.1	homes+smoke	(Virtanen, et al. 2007)	Birminghamn	32
		2.5	2.2	6	1	1.3	homes+ no smoke	(Virtanen, et al. 2007)	Birminghamn	32
		1.8				0.6	offices	(Virtanen, et al. 2007)	Birminghamn	12
		6				2.9	restaurants	(Virtanen, et al. 2007)	Birminghamn	6
		6.9				11.2	pubs	(Virtanen, et al. 2007)	Birminghamn	6
		3.5				2.5	department stores	(Virtanen, et al. 2007)	Birminghamn	8
		5.9				5.3	cinemas	(Virtanen, et al. 2007)	Birminghamn	6
		2.4				0.3	perfume shops	(Virtanen, et al. 2007)	Birminghamn	3
		3.3				2.7	libraries	(Virtanen, et al. 2007)	Birminghamn	6
		0.8				0.3	labs	(Virtanen, et al. 2007)	Birminghamn	6
		7.5				8.1	train station (waiting area+platforms)??	(Virtanen, et al. 2007)	Birminghamn	12
		3.5				1.3	coach station (waiting area+platforms)	(Virtanen, et al. 2007)	Birminghamn	12

G. mean	G. SD	Mean	Median	Max	Min	SD	Environment	Source	Location	Samples
		54.2				33.6	cars	(Virtanen, et al. 2007)	Birminghamn	36
		8				8.3	trains	(Virtanen, et al. 2007)	Birminghamn	18
		8.6				4.1	buses	(Virtanen, et al. 2007)	Birminghamn	18

Appendix 2 - Time activity patterns

Table 16. Time activity pattern for adult males and females during the working days

	Adult Males			Adult Females		
N/N	**Location/ Activity**	**Duration (h)**	**Level**	**Location / Activity**	**Duration (h)**	**Level**
1	Sleep	7	1	Sleep	7	1
2	Breakfast/Shower	1	2	Breakfast/Shower	1	2
3	Transport	0.75	2	Transport	0.5	2
4	Work	8.25	3	Work	7.5	3
5	Transport	0.75	2	Transport	0.5	2
6	Dinner	1.25	2	Shopping	1	2
7	Shopping	0.5	3	Housekeeping	1	3
8	Sport	0.5	2	Dinner	1	2
9	Home resting	1	3	Walking	1	3
10	Reading	1	1	Home resting	1.5	1
11	Sleep	1	1	Reading	1	1
12	Sleep	1	1	Sleep	1	1

Table 17. Time activity pattern for adult males and females during the weekends

	Adult Males			Adult Females		
N/N	**Location/Activity**	**Duration (h)**	**Level**	**Location/Activity**	**Duration (h)**	**Level**
1	Sleep	8	1	Sleep	8	1
2	Breakfast/Shower	1	2	Breakfast/Shower	1	1
3	Shopping	2	3	Shopping	2	3
4	Gardening	1	3	Gardening	1	3
5	Lunch	1	2	Lunch	1	2
6	Social life	3	2	Social life	3	2
7	Reading	1	1	Reading	1	1
8	Diner	1	2	Diner	1	2
9	Car driving	1	2	Car driving	1	2
10	Social life	3	2	Social life	3	2
11	Car driving	1	2	Car driving	1	2
12	Sleeping	1	1	Sleeping	1	1

Table 18. Time activity pattern for children during the working days

	Children below 1 years of age			Children between 3 to 14 years of age		
N/N	**Location**	**Duration (h)**	**Level**		**Duration (h)**	**Level**
1	Sleep	7	1	Sleep	7	1
2	Breakfast	1	2	Breakfast/Shower	1	2
3	Lie/Playing	3	2	To school	1	2
4	Sleep	1	1	School	8	2
5	Lunch	1	2	To home	1	2
6	Travelling	1	1	Dinner	1	2
7	Sleep	1	1	Sport	1	3
8	Lie/Playing	1	2	Watching TV	1	1
9	Lie/Playing	1	2	Sleeping	1	1
10	Dinner	1	2	Sleeping	1	1
11	Lie/playing	1	1	Sleeping	0.5	1
12	Sleeping	5	1	Sleeping	0.5	1

Table 19. Time activity pattern for children aged 3 to 14 during the weekends

\	Children below 1 years of age			Children between 3 to 14 years of age		
N/N	**Location/Activity**	**Duration (h)**	**Level**	**Location/Activity**	**Duration (h)**	**Level**
1	Sleep	7	1	Sleep	8	1
2	Breakfast	1	2	Breakfast/Shower	1	2
3	Lie/Playing	3	2	Sport	3	3
4	Sleep	1	1	Lunch	1	2
5	Lunch	1	2	Social life	4	2
6	Travelling	1	1	Diner	1	2
7	Sleep	1	1	Watching TV	2	1
8	Lie/Playing	1	2	Sleeping	1	1
9	Lie/Playing	1	2	Sleeping	1	1
10	Dinner	1	2	Sleeping	1	1
11	Lie/playing	1	1	Sleeping	0.5	1
12	Sleeping	5	1	Sleeping	0.5	1

Appendix 3 - Activity related inhalation rates, bodyweight and biokinetics parameters distributions

Table 20. Inhalation rates based on the intensity of activity for the several age groups

		Inhalation rates (m^3/h)			
Age	**Gender**	**Resting/sleeping**	**Light**	**Moderate**	**Heavy exercise**
0-1	Female	0.120	0.160	0.270	0.550
0-1	Male	0.120	0.160	0.270	0.550
03-08	Female	0.233	0.307	0.673	1.267
03-08	Male	0.233	0.307	0.673	1.267
09-14	Female	0.326	0.388	1.180	2.240
09-14	Male	0.354	0.420	1.220	2.360
15-64	Female	0.335	0.395	1.300	2.650
15-64	Male	0.435	0.510	1.450	2.950

Table 21. Distribution of activities according to their severity level (resting, light, moderate and heavy)

ACT_1	ACT_2	ACT_3	ACT_4
Resting	**Light**	**Moderate**	**Heavy**
Other reading	Activities related to employment	Caring for pets	Other sports outdoor activities
Radio and music	Computer and video games	Cleaning dwelling	Walking and hiking
Reading books	Eating	Construction and repairs	
Resting	Entertainment and culture	Dish washing	
Sleep	Free time study	Food preparation	
TV and video	Homework	Gardening	
	Informal help to other households	Handicraft	
	Organizational work	Ironing	
	Other computing	Laundry	
	Other domestic travel	Main and second job	
	Other personal care	Other domestic work	
	Other social life	Other hobbies and games	
	Participatory activities	Other household upkeep	

	Physical care supervision of child	Shopping and services	
	School and university	Tending domestic animals	
	Teaching reading talking with child	Walking the dog	
	Transporting a child		
	Travel related to leisure		
	Travel related to shopping		
	Travel related to study		
	Travel to from work		
	Unspecified leisure		
	Unspecified time use		
	Unspecified travel		
	Visits and feasts		

Table 22. Bodyweight distributions definition per exposed group and country

			Male	Female	Child 0-1	Child 3-14				Male	Female	Child 0-1	Child 3-14
1	**Belgium**	*Mean*	78	64	6.1	33.3	10	**Switzerland**	*mean*	75.7	61.2	7	30.1
		STD	3	3.61	2.22	9			*STD*	11.8	10.3	2.5	7.5
		Max	88	75.1	12.9	61.1			*max*	112.2	93	14.7	53.3
		Min	66	52.8	0.7	5.5			*min*	39.2	29.4	1.92	6.9
2	**Cyprus**	*Mean*	78.6	66.4	6.9	32.7	11	**UK**	*mean*	80	67	6.1	33.2
		STD	3	5.1	2.5	8.4			*STD*	13.8	12.6	2.3	6.9
		Max	87.9	82.2	14.6	58.7			*max*	123	105.9	13.2	54.5
		Min	69.3	50.6	0.9	6.7			*min*	38	28.1	1.1	11.9
3	**Czech**	*Mean*	75.8	64.3	6.92	24	12	**Hungary**	*mean*	68	58.2	7	29.1
		STD	13.5	12.3	2.45	12.4			*STD*	13.6	12.1	2.5	8.2
		Max	117.5	102.3	14.6	62.3			*max*	110	95.6	14.7	54.4
		Min	34.1	26.3	0.6	2.5			*min*	26	20.8	1.92	3.8
4	**Finland**	*Mean*	81.2	66.4	7.6	25.8	13	**Ireland**	*mean*	83	67.8	6.1	33.2
		STD	13.8	12.6	2.2	6.6			*STD*	13.2	12.6	2.3	6.9
		Max	123.9	105.3	14.4	46.2			*max*	123.8	106.7	13.2	54.5
		Min	38.6	27.5	0.8	5.4			*min*	43.2	28.9	1.1	11.9
5	**France**	*Mean*	74.8	61	6.1	26.6	14	**Netherlands**	*mean*	75.7	61.2	7.9	31.6
		STD	2.7	3.2	2.3	2.8			*STD*	11.8	10.3	2.2	6.8
		Max	84.7	70.9	13.2	35.3			*max*	112.2	93	14.7	52.6
		Min	64.9	51.1	0.9	18			*min*	39.2	29.4	1.6	10.6
6	**Germany**	*Mean*	75.8	64.3	6.1	26.6	15	**Poland**	*mean*	79.3	66.8	7	30.4
		STD	13.5	12.3	2.3	2.8			*STD*	14.9	14	2.5	8
		Max	117.5	102.3	13.2	35.2			*max*	125.3	110.1	14.7	55.1
		Min	34.1	26.3	0.6	18			*min*	33.3	23.5	1.92	5.7
7	**Greece**	*Mean*	78.6	66.4	7.9	32.2	16	**Portugal**	*mean*	75.7	62.5	6.1	33.2
		STD	3	5.1	1.9	7.5			*STD*	2.6	5.1	2.3	10.3
		Max	87.9	82.2	13.8	55.4			*max*	83.7	78.2	13.2	65
		Min	69.3	50.6	2	9			*min*	67.7	46.7	1.9	3.1
8	**Italy**	*Mean*	72.8	60.8	6.9	33.8	17	**Romania**	*mean*	79.3	66.8	7	31.8
		STD	11.8	11.1	2.5	8.3			*STD*	14.9	14	2.5	8.7
		Max	109.3	95.1	14.6	8.2			*max*	125.3	110.1	14.7	4.9
		Min	36.3	26.5	1.1	59.5			*min*	33.3	23.5	1.92	58.7
9	**Spain**	*mean*	75.7	62.5	6.1	33.2	18	**Slovenia**	*mean*	79.3	66.8	7	30.5
		STD	2.6	5.1	2.3	10			*STD*	14.9	14	2.5	8
		max	83.7	78.3	13.2	64.1			*max*	125.3	110.1	14.7	55.2
		min	67.7	46.7	1.1	33.2			*min*	33.3	23.5	1.92	5.8

Table 23. Important biokinetics parameters

Variable name	mean	min	max	STD
Bone marrow V_{max} (µmol/h/kg)	14	0.03	29	4.8
Liver V_{max} (µmol/h/kg)	15	0.18	30	5
Q_{venc} (l/h/kg)	18	9.2	26	2.5

Appendix 4 - Assumed concentration distribution

Table 24. Assumed concentration distribution for Benzene (in µg/m^3)

Country	Location																				
	Homes				Schools/kindergartens				offices/public buildings				bars/cafes/restaurants/shops				train/bus/car/taxi				Outdoor
	Mean	*Max*	Min	SD	Mean	*Max*	Min	SD	Mean	*Max*	Min	SD	Mean	*Max*	Min	SD	Mean	*Max*	Min	SD	Mean
Belgium	6.3	33.0	0.8	4.1	3.7				2.5	3.9	1.5	0.4	3.0				27.5				3.4
Cyprus	4.6				3.1	5.6	1.5	0.6	4.3	9.6	1.7	1.2	4.9				16.0				2.5
Czech	8.0	36.2	1.2	4.6	4.8				7.6				8.4				27.1				4.5
Finland	2.2	17.1	0.1	1.9	0.9	1.1	0.8	0.1	0.9	1.3	0.7	0.1	2.8	6.1	1.1	0.8	7.6				2.0
France	4.6	58.4	0.1	5.8	9.0	103.3	0.3	10.6	0.2	1.9	0.0	0.2	4.9				16.0				4.0
Germany	3.5	14.1	0.6	1.8	1.1	1.8	0.6	0.2	2.5	3.9	1.5	0.4	3.7				16.7				2.0
Greece	8.1	66.2	0.5	7.4	5.3	10.7	2.4	1.3	22.3	79.4	4.7	10.4	8.6				28.2				6.0
Hungary	11.0				6.5	25.8	1.2	3.3	1.9	2.7	1.2	0.2	11.7				38.3				6.0
Ireland	1.6	5.5	0.4	0.7	1.9	2.6	1.3	0.2	2.2	2.9	1.8	2.2	2.0				5.6				3.0
Italy	6.8	241.7	0.0	21.1	3.1	4.4	2.1	0.4	5.0	17.1	1.1	2.2	6.1				0.6				3.0
Netherlands	6.7	18.8	2.0	2.5	3.1	8.1	1.0	1.1	2.8	6.2	1.2	0.8	7.1				23.3				3.0
Poland	28.8	404.4	0.6	39.3	17.0				27.1				30.5				100.4				6.0
Portugal	5.2				4.2	9.0	1.7	1.1	5.8				4.1	7.8	2.0	0.9	9.2				4.1
Romania	7.9	24.0	2.1	3.2	4.6				10.3				20.1				18.1				8.0
Slovenia	2.2	4.8	0.9	0.6	2.5				3.6				4.2				7.7				7.0
Spain	4.0	88.7	0.0	7.9	6.0				7.9				3.0	11.9	0.5	1.5	16.9	63.0	3.3	8.2	4.5
Switzerland	3.0	27.4	0.2	3.0	1.8				2.8				3.2				10.5				2.0
UK	7.2	127.5	0.1	11.8	4.3				16.4	324.8	1.2	29.3	17.4	316.5	0.2	29.1	67.1	1,279.0	0.7	116.4	2.0
Average	**6.8**	**76.9**	**0.6**	**7.7**	**4.6**	**17.2**	**1.3**	**1.9**	**7.0**	**41.2**	**1.5**	**4.3**	**8.1**	**85.6**	**1.0**	**8.1**	**24.3**	**671.0**	**2.0**	**62.3**	**4.1**

Table 25. Assumed concentration distribution for Toluene (in µg/m^3)

Country	Location																				
	Homes				**Schools/kindergartens**				**offices/public buildings**				**bars/cafes/restaurants/shops**				**train/bus/car/taxi**				**Outdoor**
	Mean	***Max***	***Min***	***SD***	***Mean***	***Max***	***Min***	***SD***	***Mean***	***Max***	***Min***	***SD***	***Mean***	***Max***	***Min***	***SD***	***Mean***	***Max***	***Min***	***SD***	***Mean***
Belgium	9.4	62.0	0.8	7.3	4.4				10.3	46.5	1.5	5.9	26.7				67.0				10.2
Cyprus	36.4	607.5	0.5	56.8	7.0				13.5	88.3	1.1	10.4	79.3				64.2				7.5
Czech	47.3	920.1	0.5	83.5	9.1				5.0	16.3	1.2	2.1	103.1				83.4				13.5
Finland	16.4	247.4	0.3	23.6	3.2				5.4	190.0	0.0	16.6	12.1	42.0	2.7	5.5	28.9				6.0
France	20.1	522.5	0.1	45.7	7.0	26.4	13.8	3.4	3.8	11.5	2.4	2.6	43.8				35.4				12.0
Germany	31.7	509.1	0.5	48.0	6.1				6.6	76.5	0.2	7.8	69.1				54.9				6.0
Greece	35.1	1,542.7	0.0	140.1	6.8				76.7	256.9	17.7	33.7	26.7				61.9				18.0
Ireland	6.1	10.0	3.5	1.0	1.2				3.6	11.0	0.9	1.4	13.3				10.8				18.0
Italy	77.6	626.6	4.5	70.1	14.9				11.6	281.0	0.1	24.7	246.6				7.6				9.0
Netherlands	8.9	84.1	0.4	9.0	1.7				4.7	33.2	0.4	3.8	19.4				15.7				9.0
Poland	58.4	513.8	2.9	56.2	11.2				33.7				127.3				103.0				9.0
Spain	16.2	175.5	0.6	18.2	3.1				25.6				20.0	67.1	4.6	8.8	64.3	179.0	19.0	23.3	18.0
Switzerland	19.5	108.0	2.1	13.2	3.8				11.3				42.5				34.4				12.3
UK	31.3	456.7	0.6	44.0	6.0				46.7	1,031.3	0.3	91.7	55.3	753.1	1.2	73.7	67.1	2,229.3	0.2	194.0	24.0
Average	**29.6**	**456.1**	**1.2**	**44.0**	**6.1**	**26.4**	**13.8**	**3.4**	**18.5**	**185.7**	**2.3**	**18.3**	**63.2**	**287.4**	**2.8**	**29.3**	**49.9**	**1,204.1**	**9.6**	**108.7**	**12.3**

Table 26. Assumed concentration distribution for Ethylbenzene in µg/m^3

Country	**Location**																				
	Homes				**Schools/kindergartens**				**offices/public buildings**				**bars/cafes/restaurants/shops**				**train/bus/car/taxi**				**Outdoor**
	Mean	*Max*	Min	SD	Mean	*Max*	Min	SD	Mean	*Max*	Min	SD	Mean	*Max*	Min	SD	Mean	*Max*	Min	SD	Mean
Belgium	0.6				1.1				0.6				0.6				31.5				2.4
Czech	9.1	89.8	0.3		1.7				2.5				6.3				17.7				1.8
Finland	2.9	25.4	0.2	2.8	0.5				0.8				1.7	6.1	0.3	0.8	5.6				3.2
France	3.1	270.1	-	44.2	1.3	7.4	0.1	0.9	0.8	2.2	0.4	0.5	2.1				6.0				1.4
Germany	3.2	32.0	0.1	3.4	0.6				3.6				2.2				16.2				2.8
Greece	7.7	38.4	1.0	4.8	1.4				2.3	9.3	0.4	1.2	5.3				15.0				1.4
Italy	10.7	98.4	0.5	10.6	1.9				1.9	4.5	0.7	0.6	17.3				0.9				4.2
Poland	40.3	805.3	0.4	72.7	7.3				11.0				27.7				78.3				4.2
Switzerland	2.7	12.9	0.3	1.6	0.5				0.7				1.9				5.3				2.1
Spain	2.3	40.9	0.03	4.3	0.4				0.6				2.0	10.9	0.2	1.3	9.1	51.6	1.0	6.3	2.1
UK	2.2	17.0	0.1	1.9	0.4				3.5	71.1	0.3	6.4	5.0	122.1	0.03	10.8	17.3	243.7	0.4	23.7	2.1
Average	**7.7**	**143.0**	**0.3**	**16.3**	**1.5**	**7.4**	**0.1**	**0.9**	**2.6**	**21.8**	**0.4**	**2.2**	**6.6**	**46.4**	**0.2**	**4.3**	**18.4**	**147.6**	**0.7**	**15.0**	**2.5**

Table 27. Assumed concentration distribution for Xylene µg/m³

Country	Location																				
	Homes				**Schools/kindergartens**				**offices/public buildings**				**bars/cafes/restaurants/shops**				**train/bus/car/taxi**				**Outdoor**
	Mean	Max	Min	SD	Mean	Max	Min	SD	Mean	Max	Min	SD	Mean	Max	Min	SD	Mean	Max	Min	SD	Mean
Belgium	3.9	9.7	1.4	1.2	3.5				4.1	9.9	1.5	9.9	4.1				11.7				6.8
Cyprus	12.8	141.4	0.4	14.6	4.2				7.7	25.3	1.8	3.3	6.5				29.5				5.0
Czech	28.6	275.4	1.2	29.4	9.3				33.5				14.4				66.0				9.0
Finland	7.8	86.4	0.3	8.9	3.0	190.0	0.0	21.0	3.9	192.3	0.0	18.3	6.5	23.9	1.3	3.1	11.0				4.0
France	7.6	345.1	0.0	31.6	4.8	32.0	0.0	16.9	2.4	4.0	1.4	0.4	3.8				17.5				8.0
Germany	9.2	113.1	0.2	11.3	3.0				3.1	7.5	1.0	1.0	4.6				64.5				4.0
Greece	11.4	26.1	4.4	3.3	3.7				106.8	507.0	14.8	64.0	5.7				26.3				12.0
Hungary	4.1	12.0	1.2	1.6	1.3				3.1	10.6	0.7	1.4	2.1				9.5				12.0
Ireland	3.6	8.1	1.4	1.0	1.2				3.8	10.0	1.3	1.2	1.8				8.3				6.0
Italy	48.0	430.8	2.3	46.8	15.6				9.4	343.7	0.0	30.0	7.6				6.0				6.0
Netherlands	3.2	17.2	0.4	2.1	1.0				3.2	23.0	0.2	2.7	1.6				7.4				6.0
Switzerland	10.6	53.4	1.4	6.7	3.4				12.4				5.3				24.5				12.0
Spain	6.6	114.0	0.1	10.5	2.1				7.7				6.3	48.4	0.4	5.5	34.6	173.0	4.5	21.5	8.2
UK	5.8	171.4	0.0	14.9	1.9				3.4	77.1	0.0	6.8	4.9	121.1	0.0	10.7	18.6	268.4	0.3	26.0	16.0
Average	**11.7**	**128.9**	**1.0**	**13.1**	**4.1**	**111.0**	**0.0**	**19.0**	**14.6**	**110.0**	**2.1**	**12.6**	**5.4**	**64.5**	**0.6**	**6.4**	**23.9**	**220.7**	**2.4**	**23.8**	**8.2**

Appendix 5 - Benzene exposure and internal dose diurnal variability

Belgium

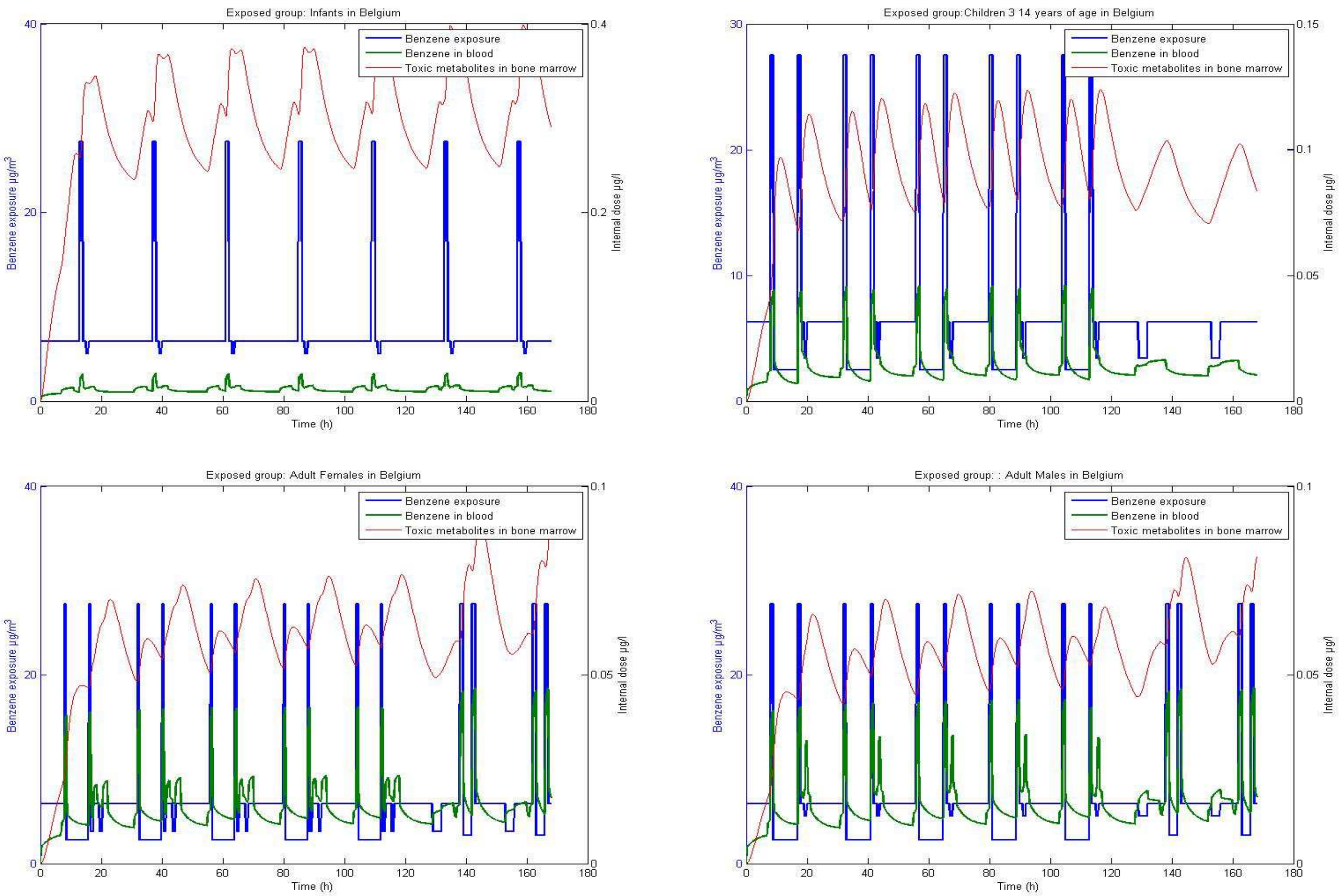


Figure 24. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Belgium

Cyprus

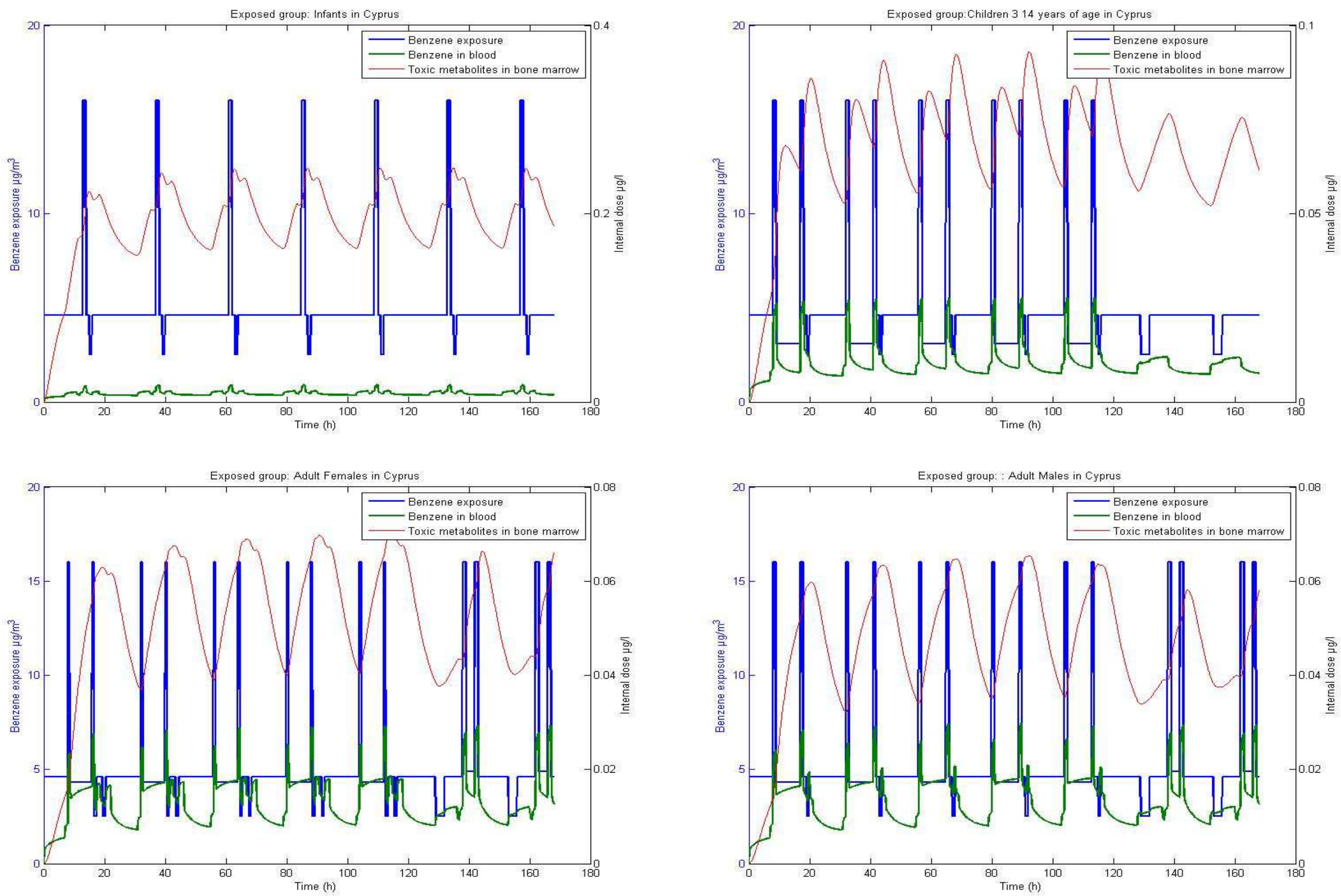


Figure 25. Benzene exposure (y1-axis) and internal dose (y2-axis) for a representative week for all population groups in Cyprus

Czech Republic

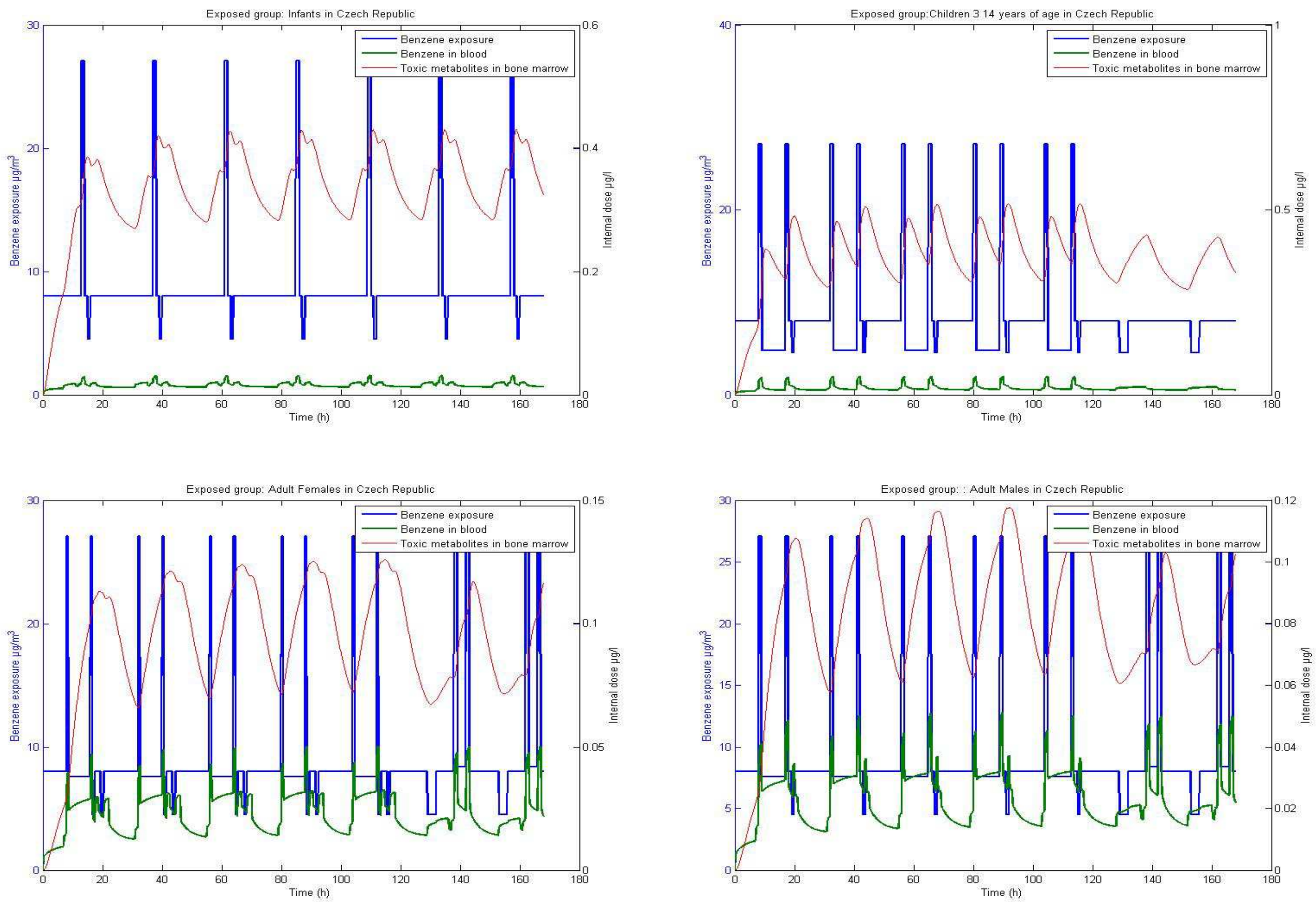


Figure 26. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Czech Republic

Finland

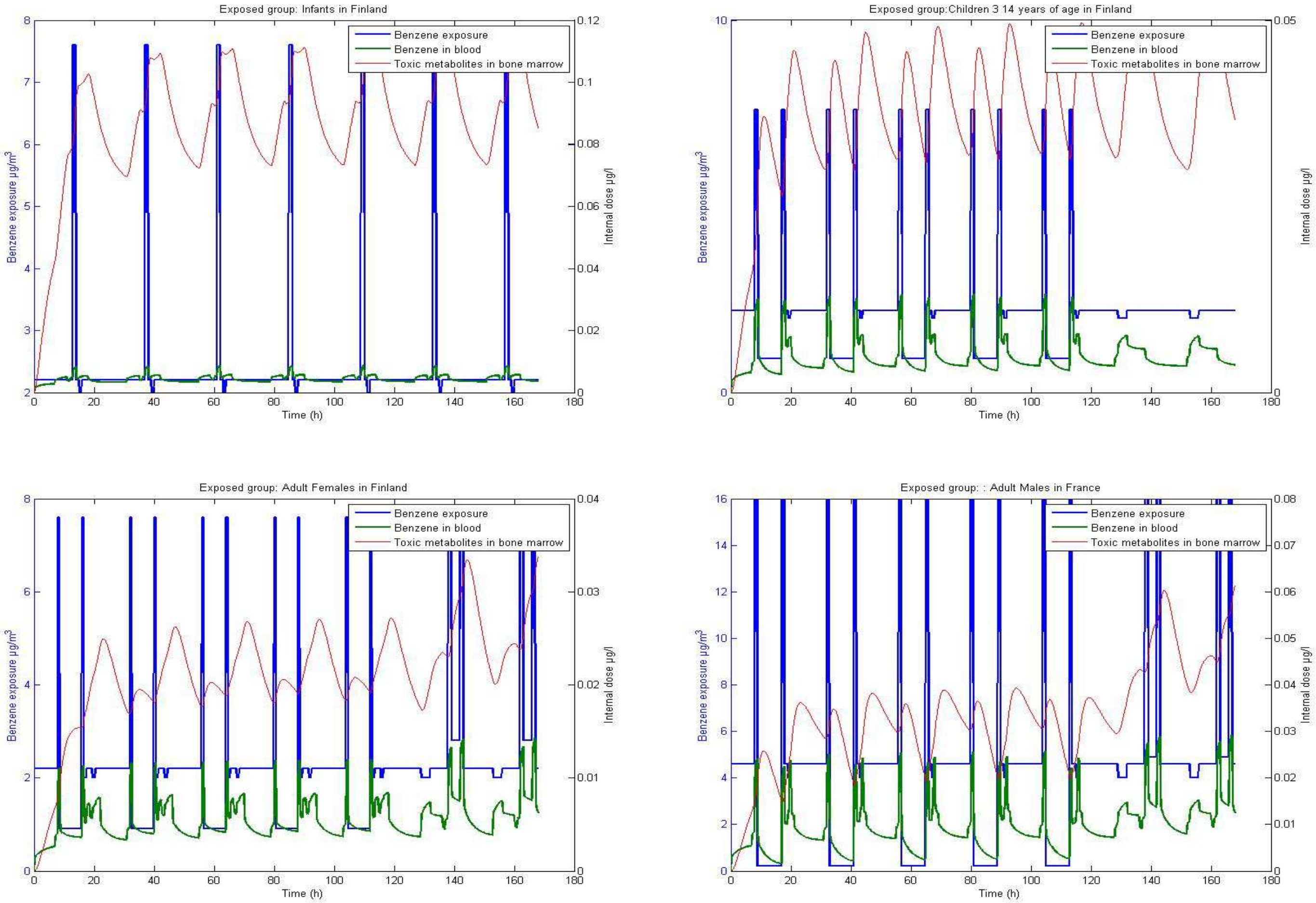


Figure 27. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Finland

France

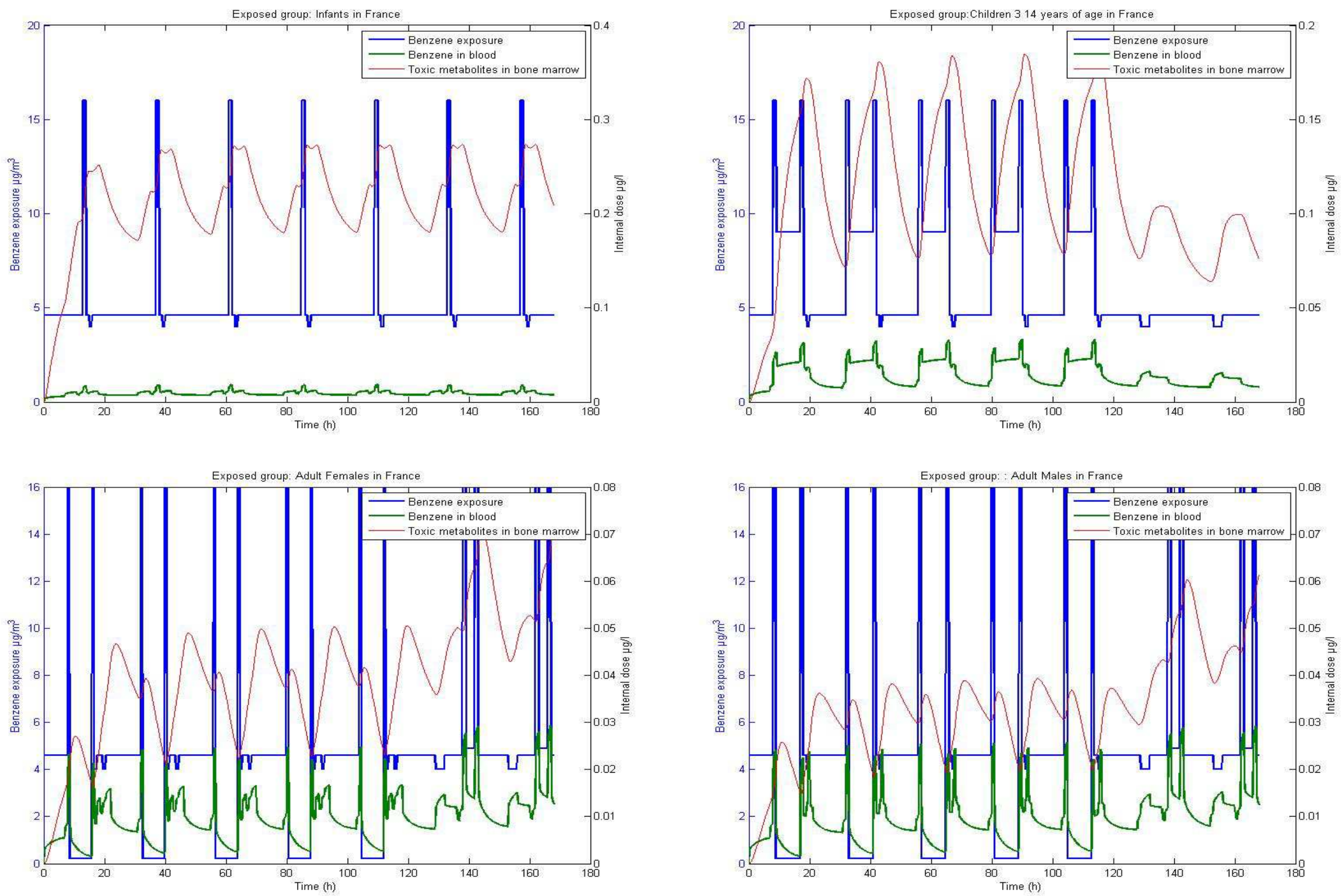


Figure 28. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in France

Germany

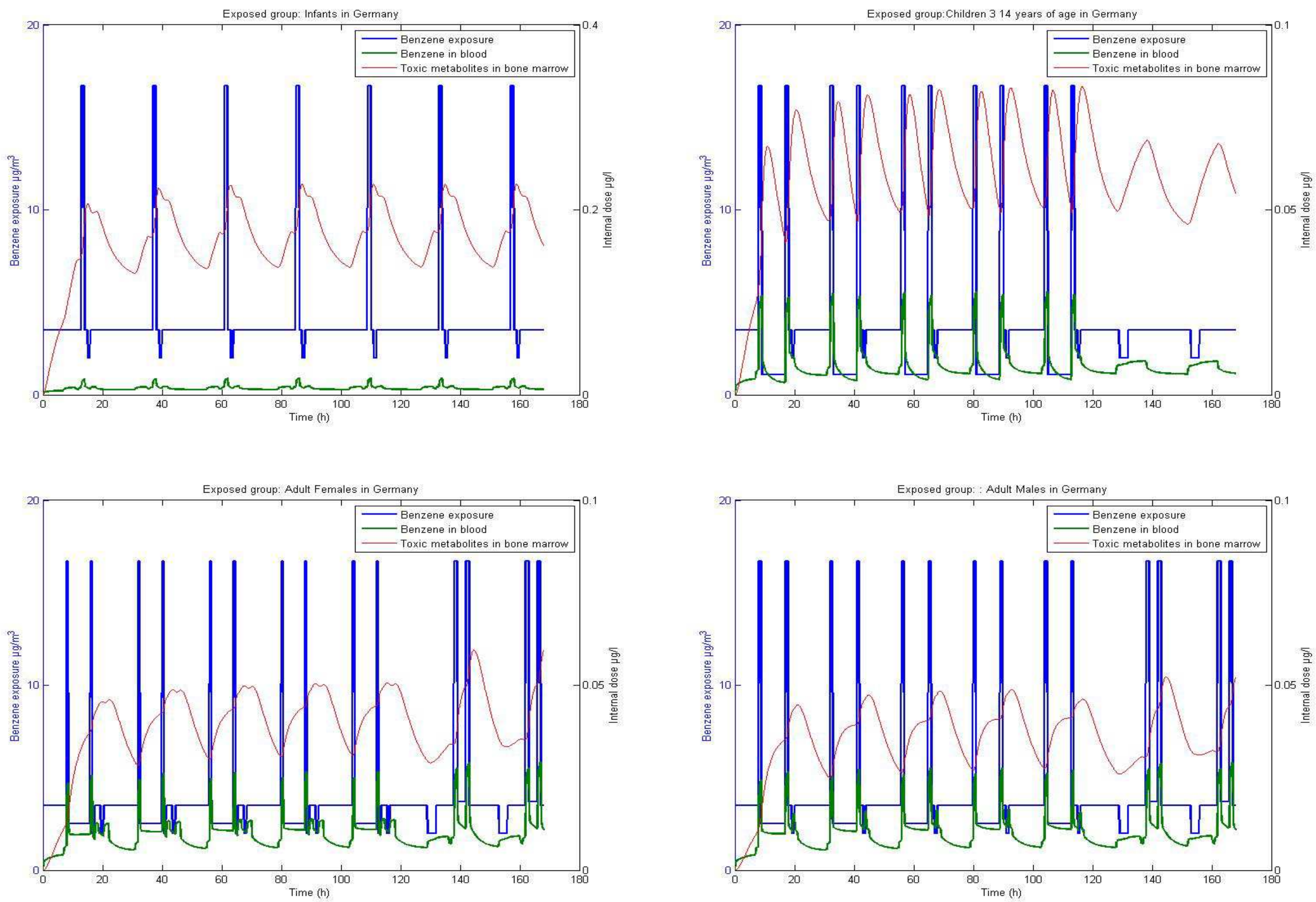


Figure 29. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Germany

Greece

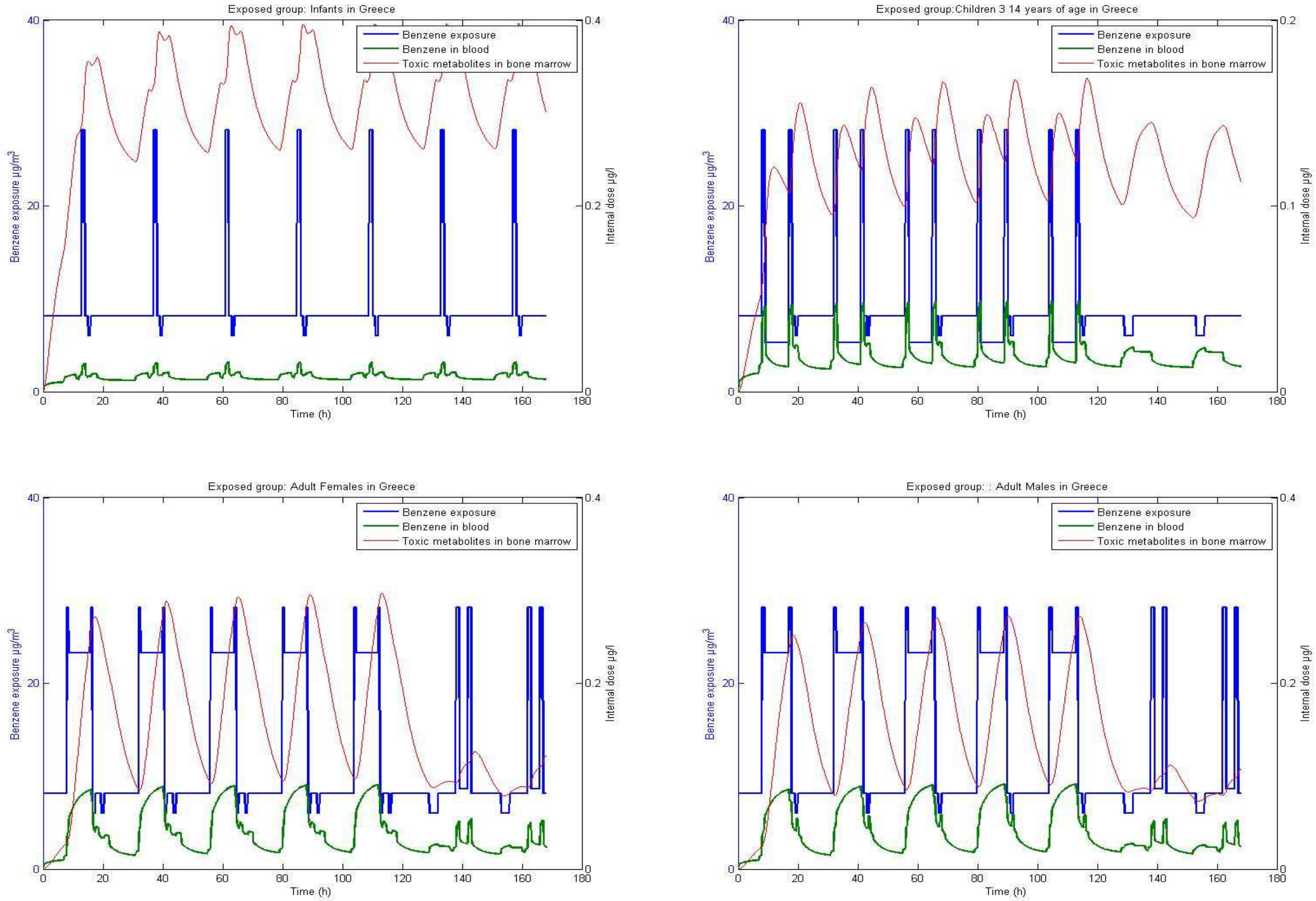


Figure 30. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Greece

Hungary

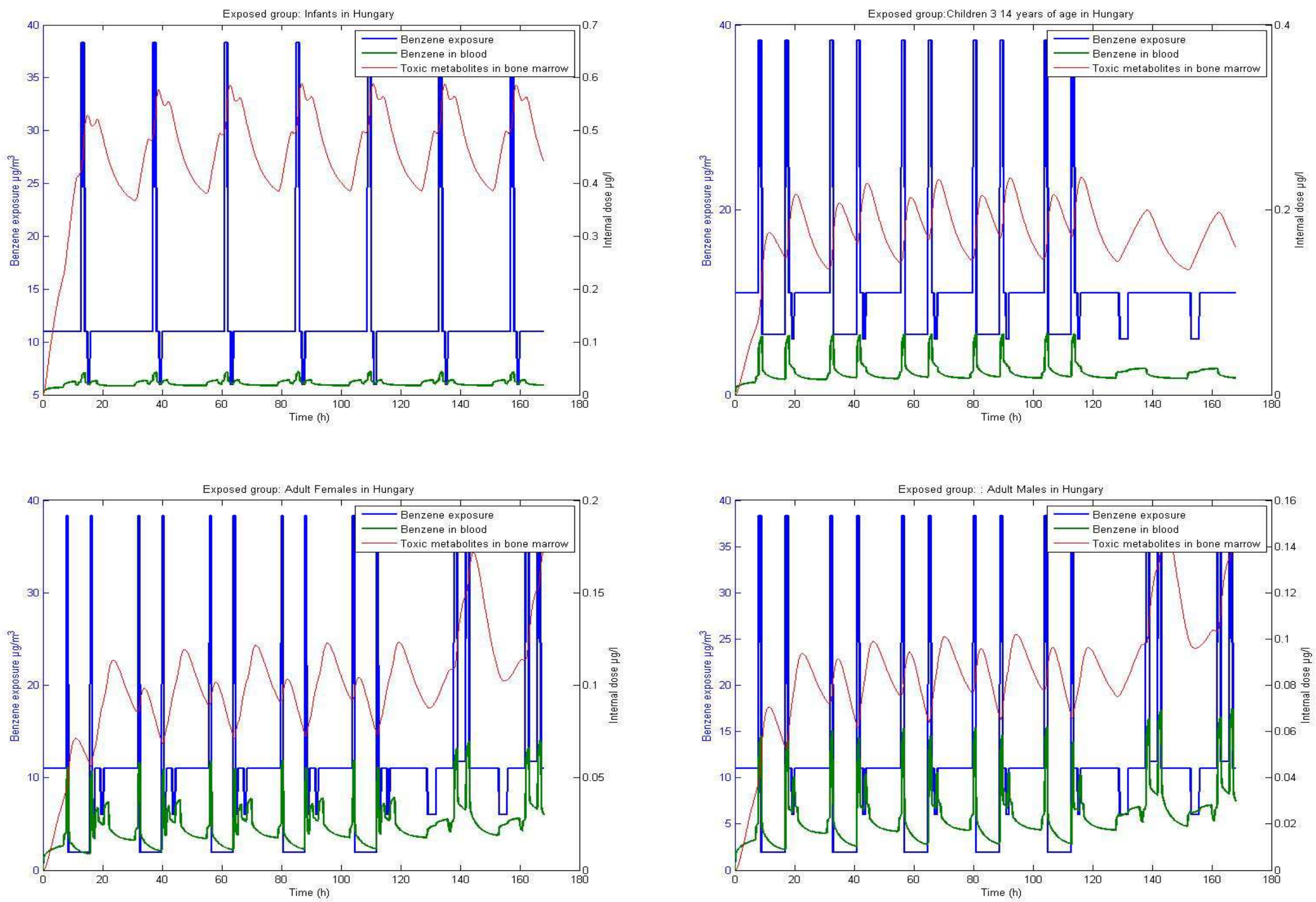


Figure 31. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Hungary

Ireland

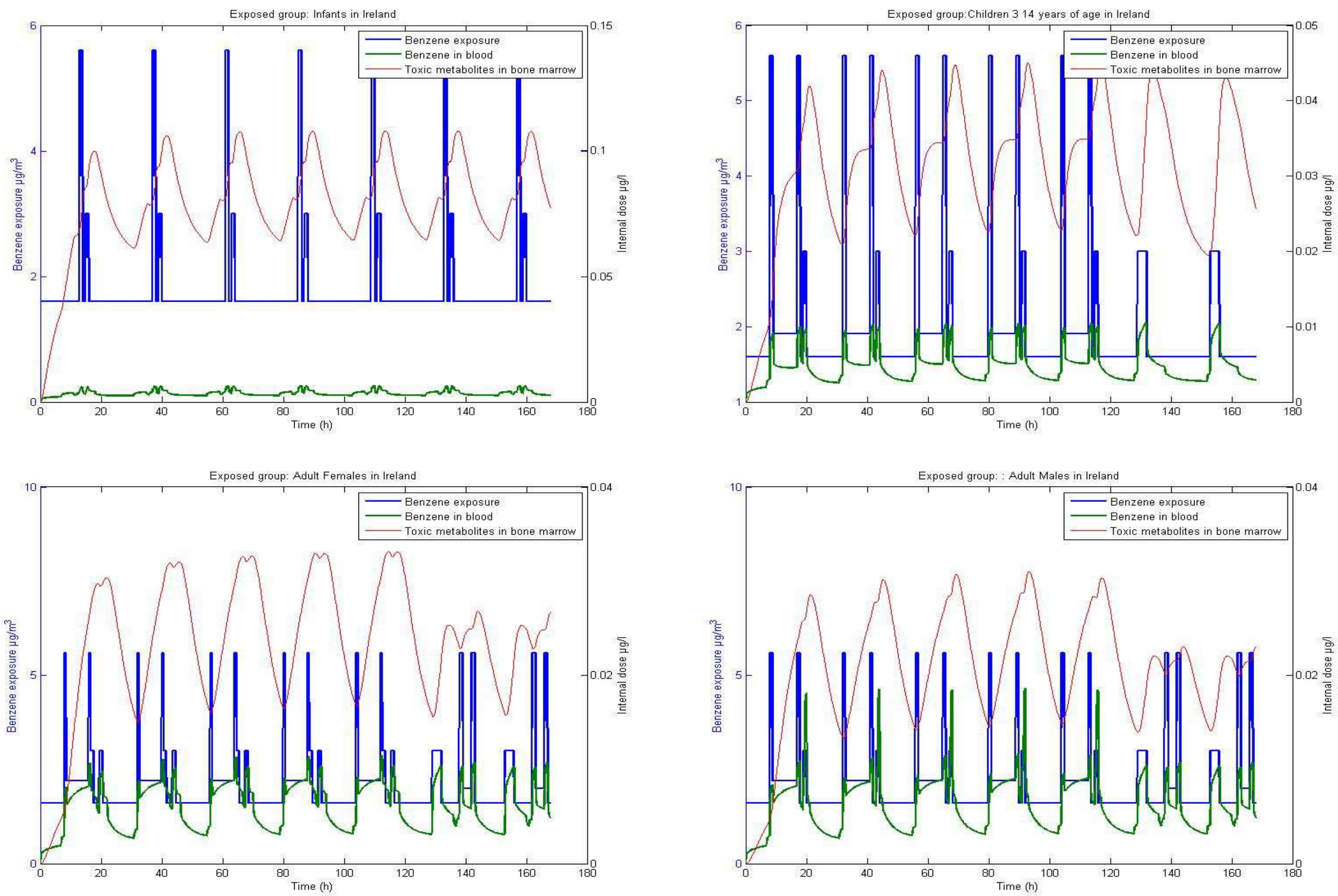


Figure 32. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Ireland

Italy

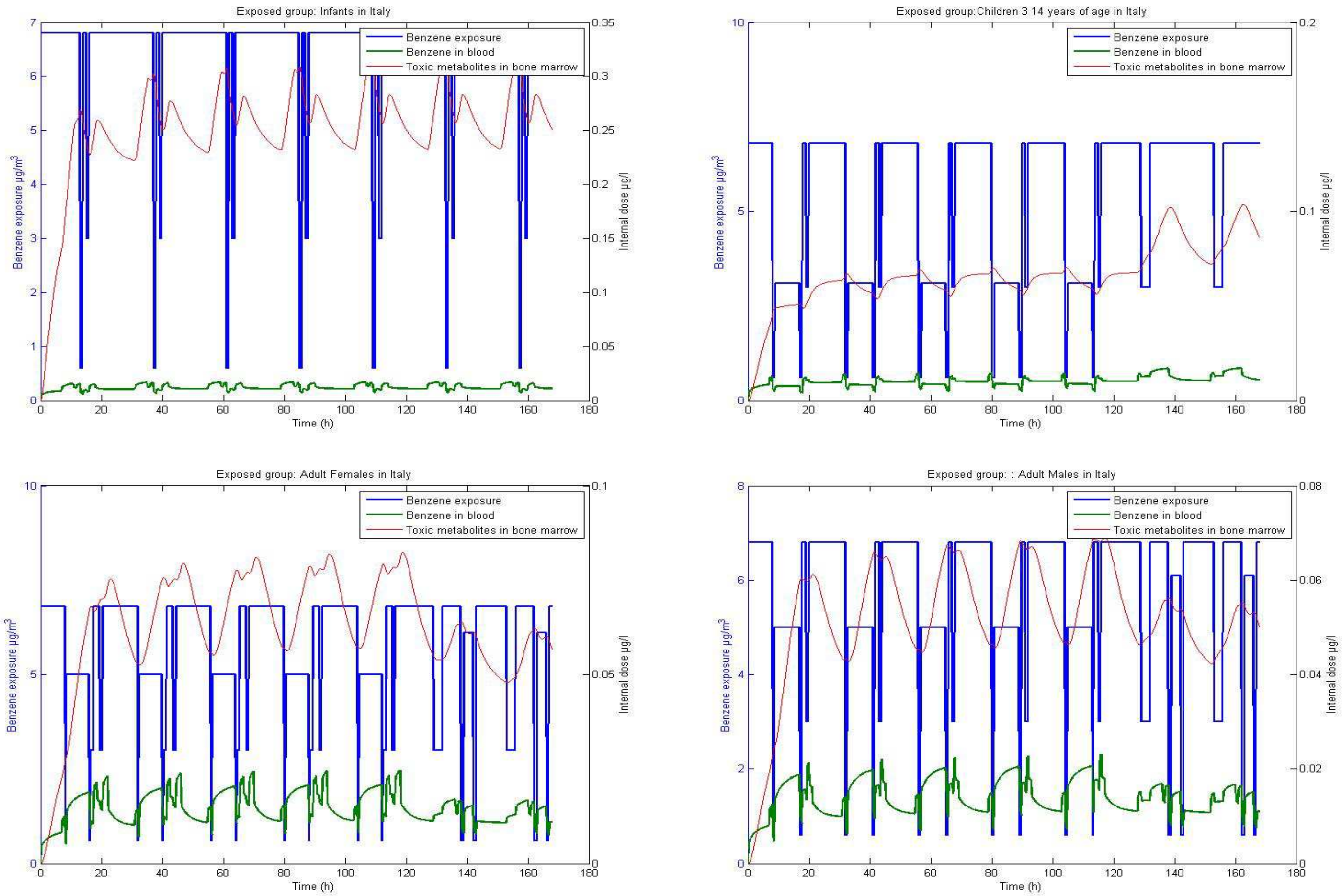


Figure 33. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Italy

Netherlands

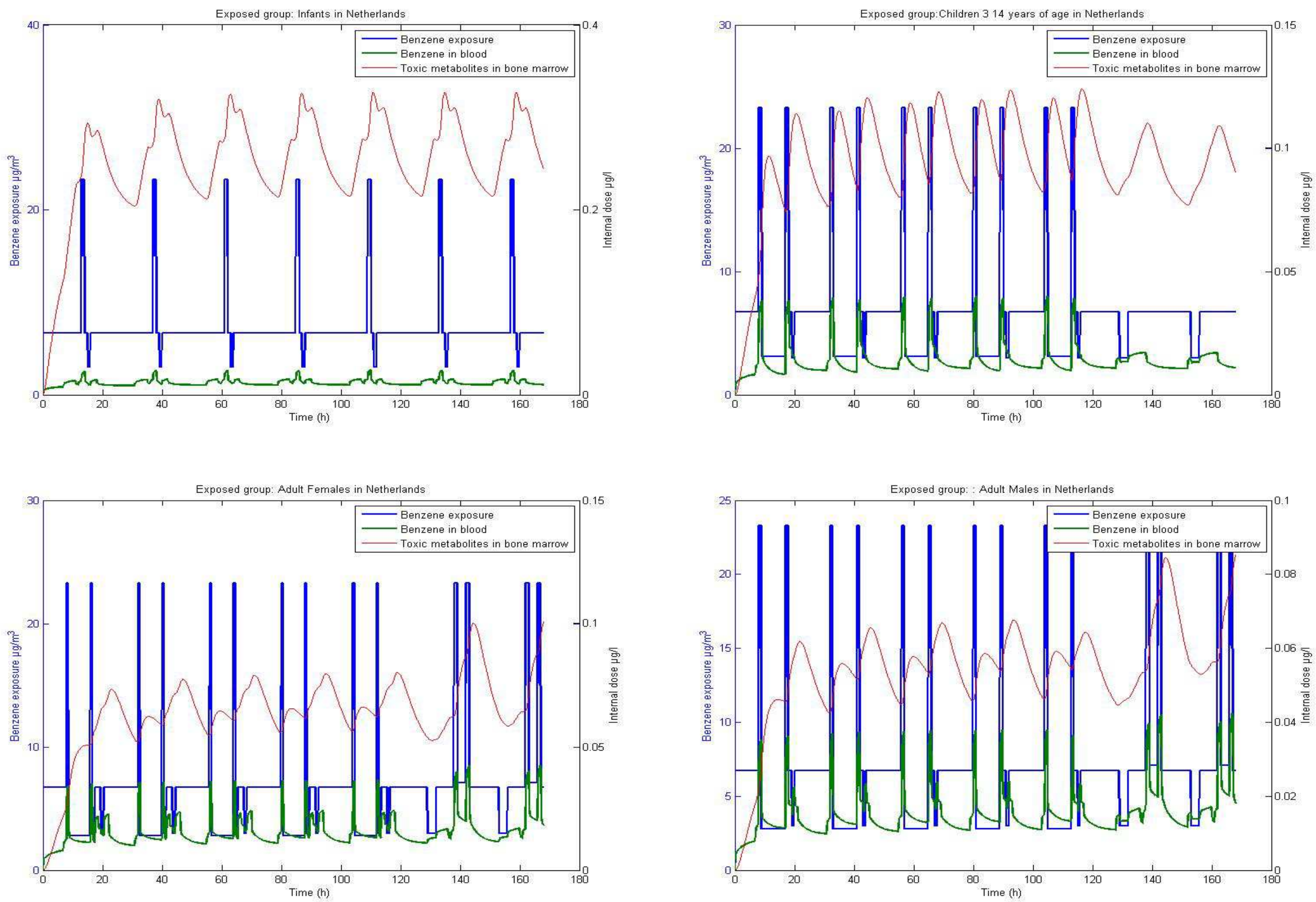


Figure 34. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Netherlands

Poland

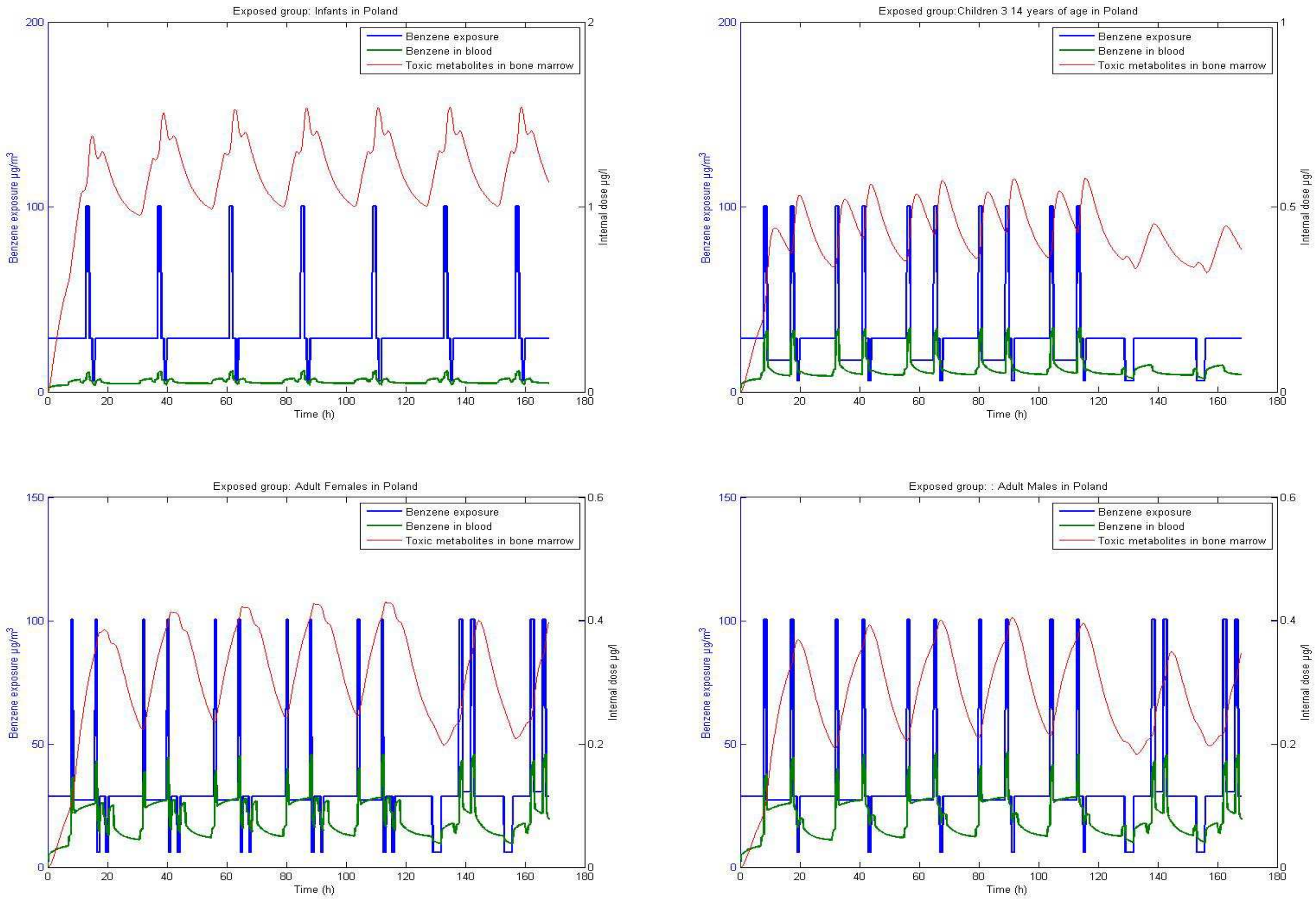


Figure 35. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Poland

Portugal

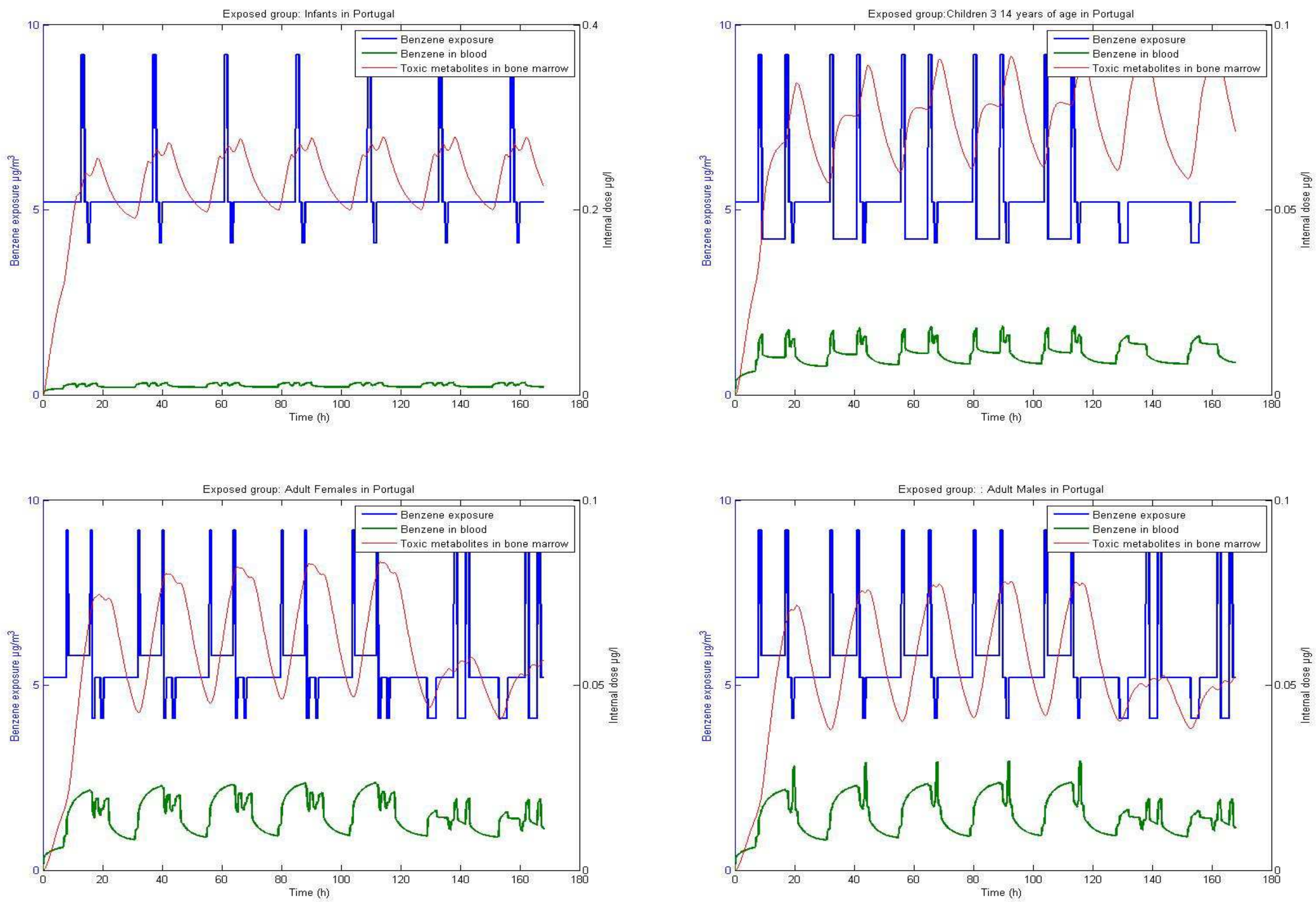


Figure 36. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Portugal

Romania

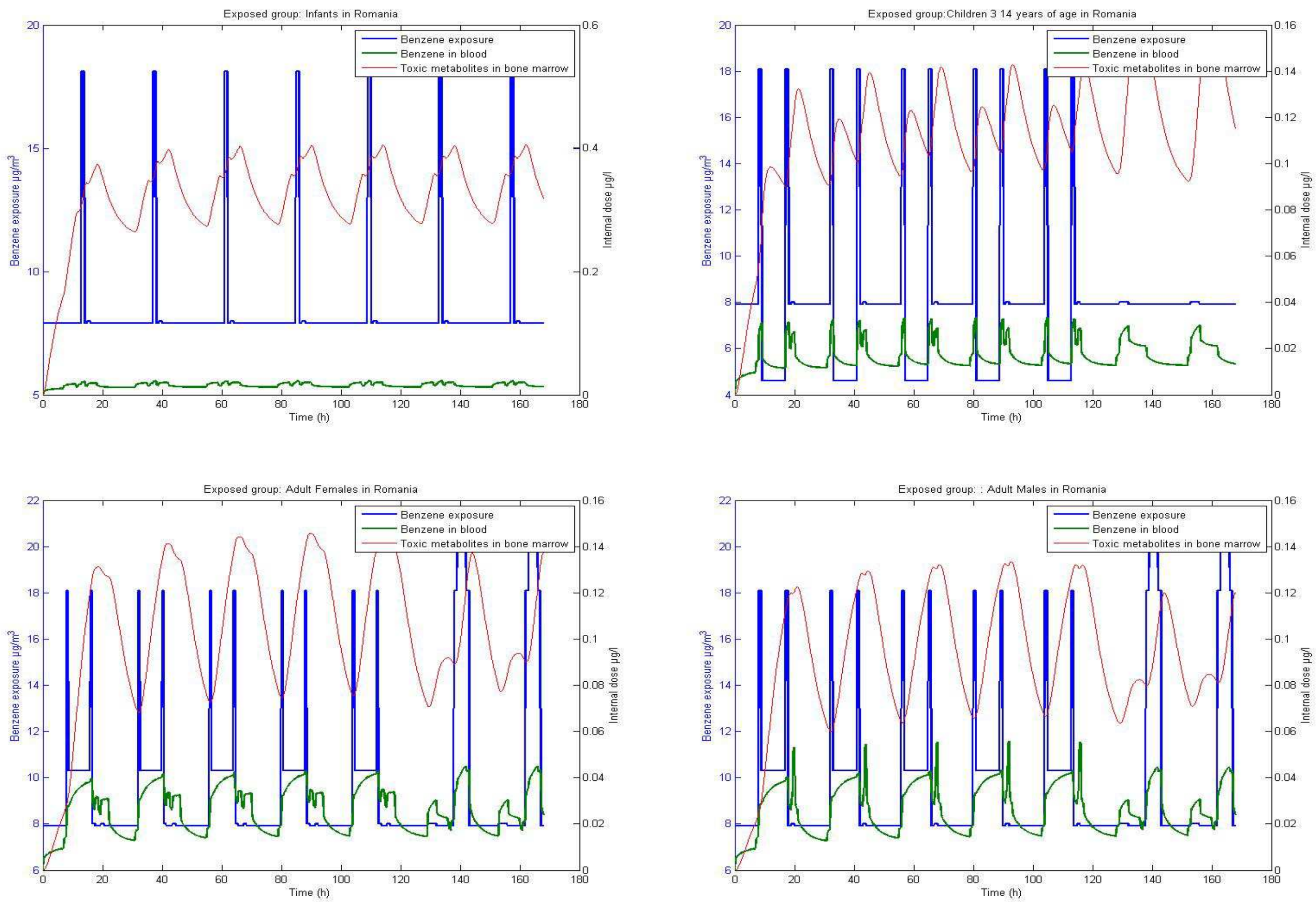


Figure 37. Benzene Exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Romania

Slovenia

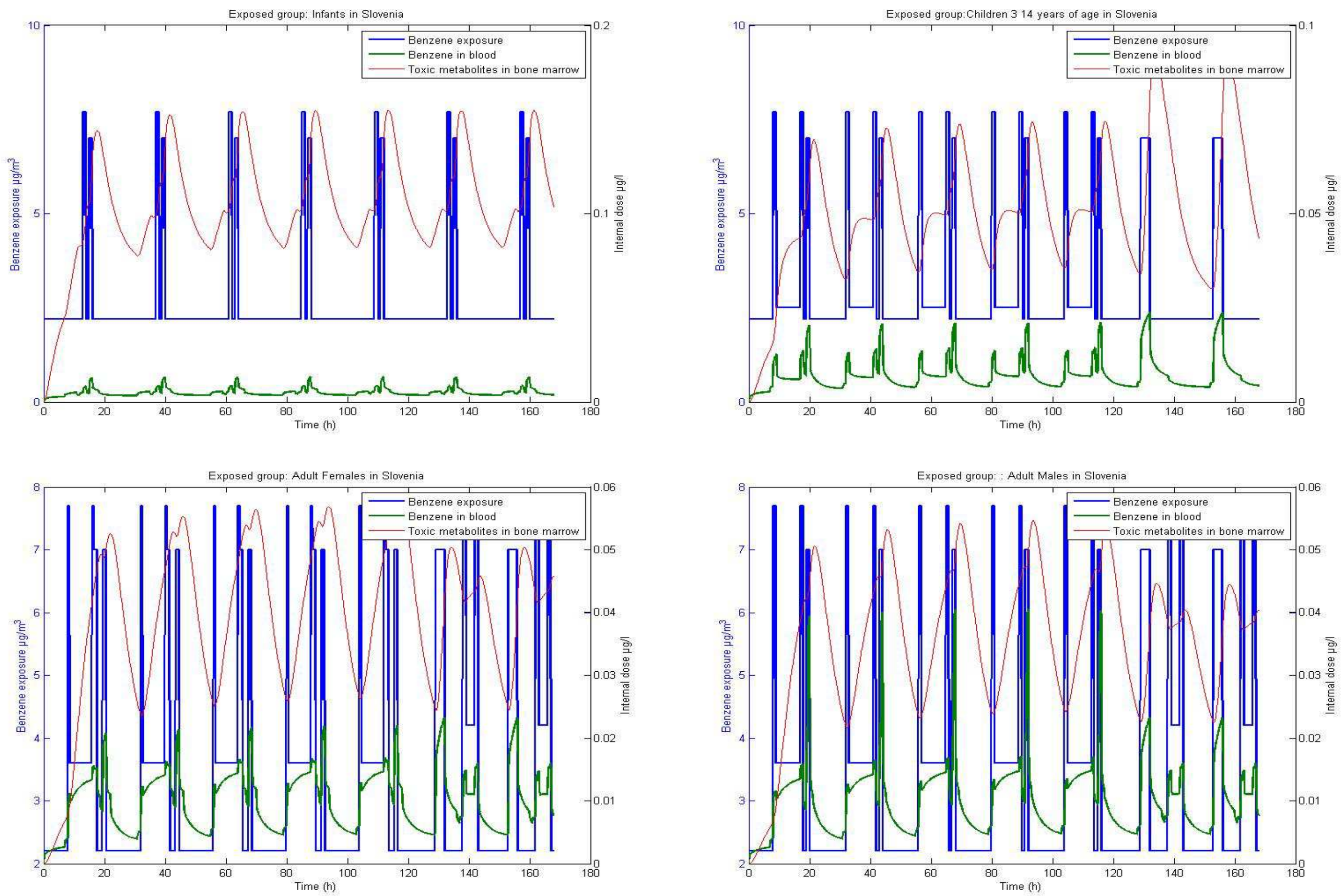


Figure 38. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all population groups in Slovenia

Spain

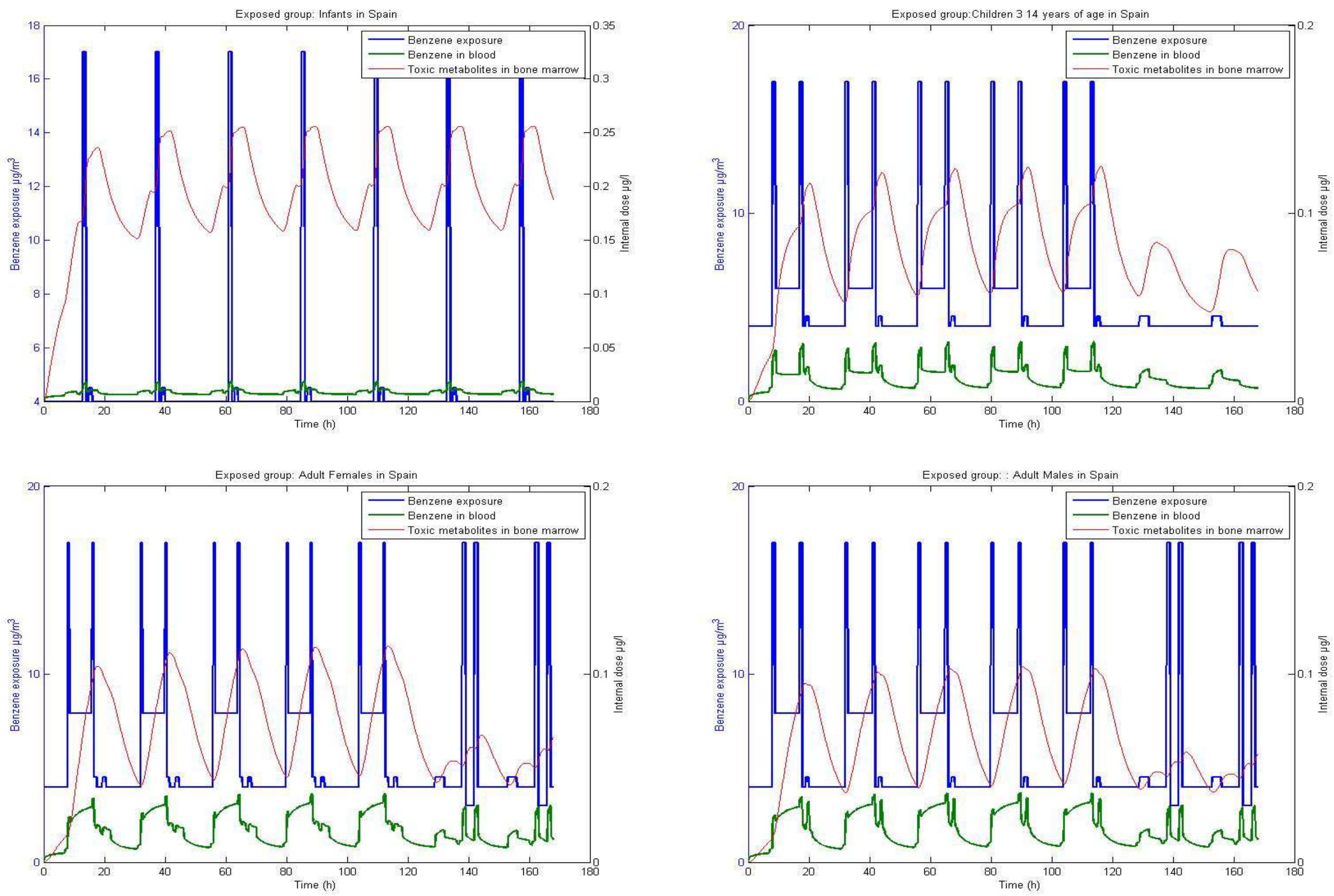


Figure 39. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all exposed groups in Spain

Switzerland

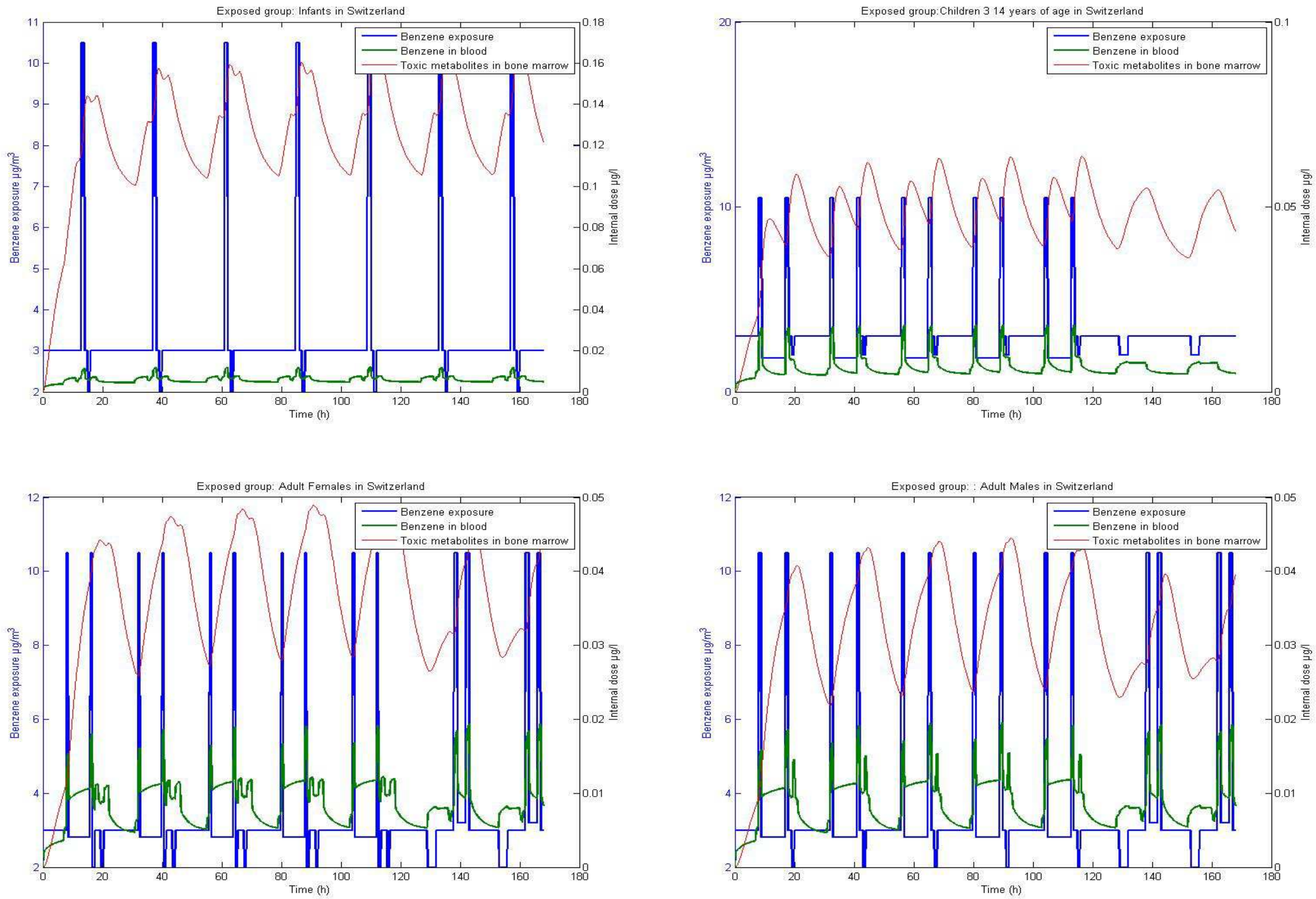


Figure 40. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all exposed groups in Switzerland

UK

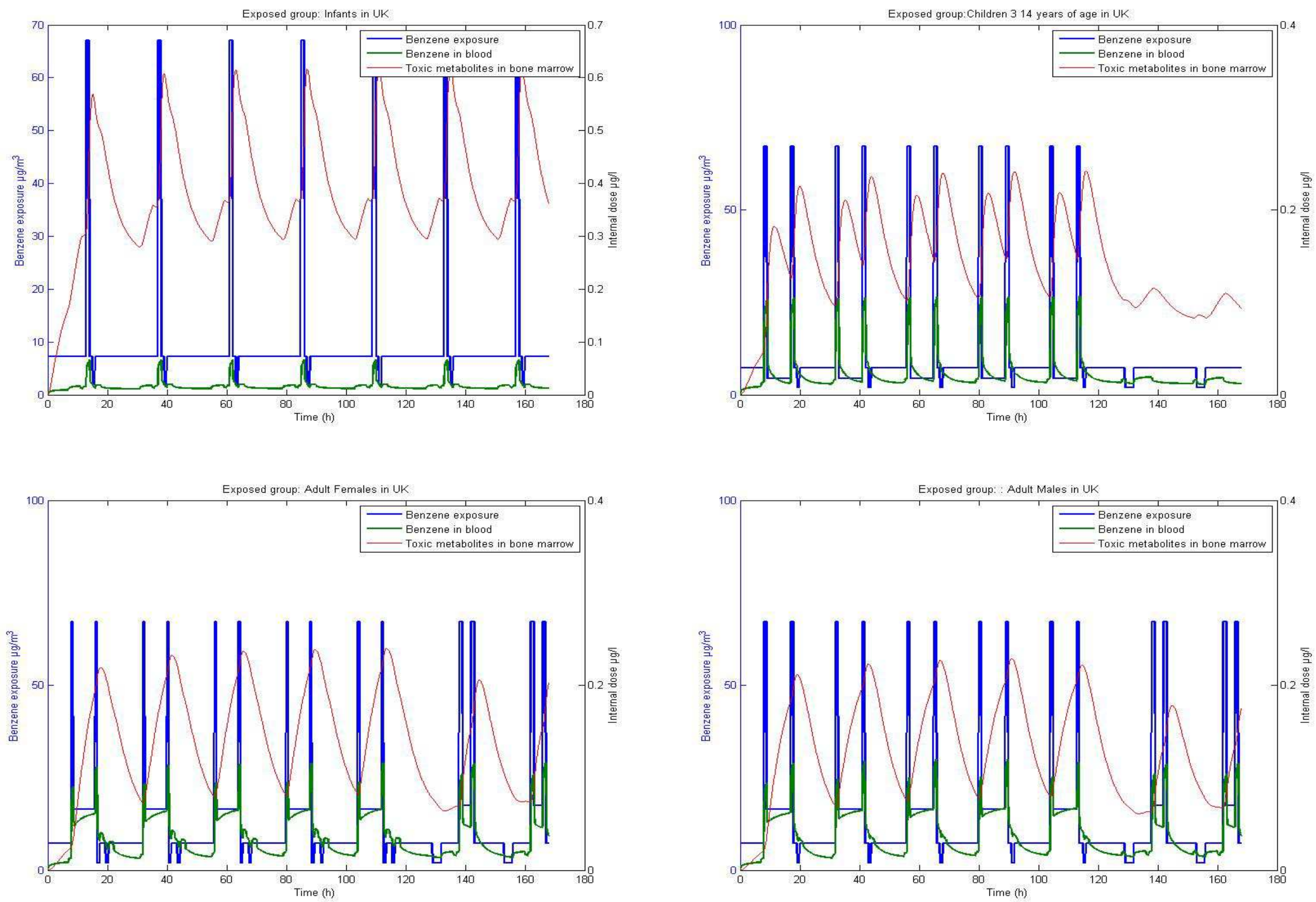


Figure 41. Benzene exposure (y_1-axis) and internal dose (y_2-axis) for a representative week for all exposed groups in UK

Appendix 6 – Toluene, ethylbenzene and xylenes exposure diurnal variability

Belgium

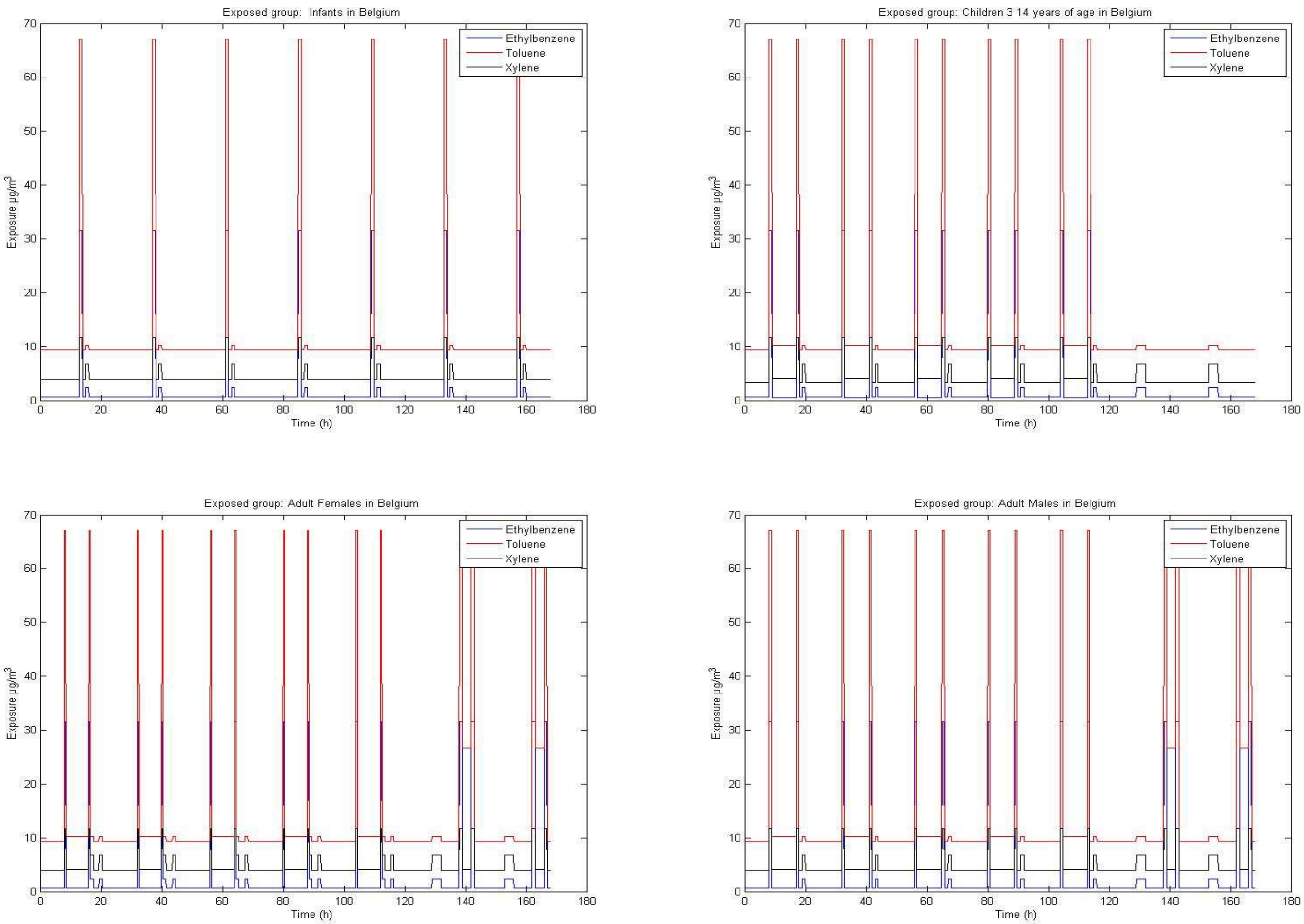


Figure 42. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Belgium

Cyprus

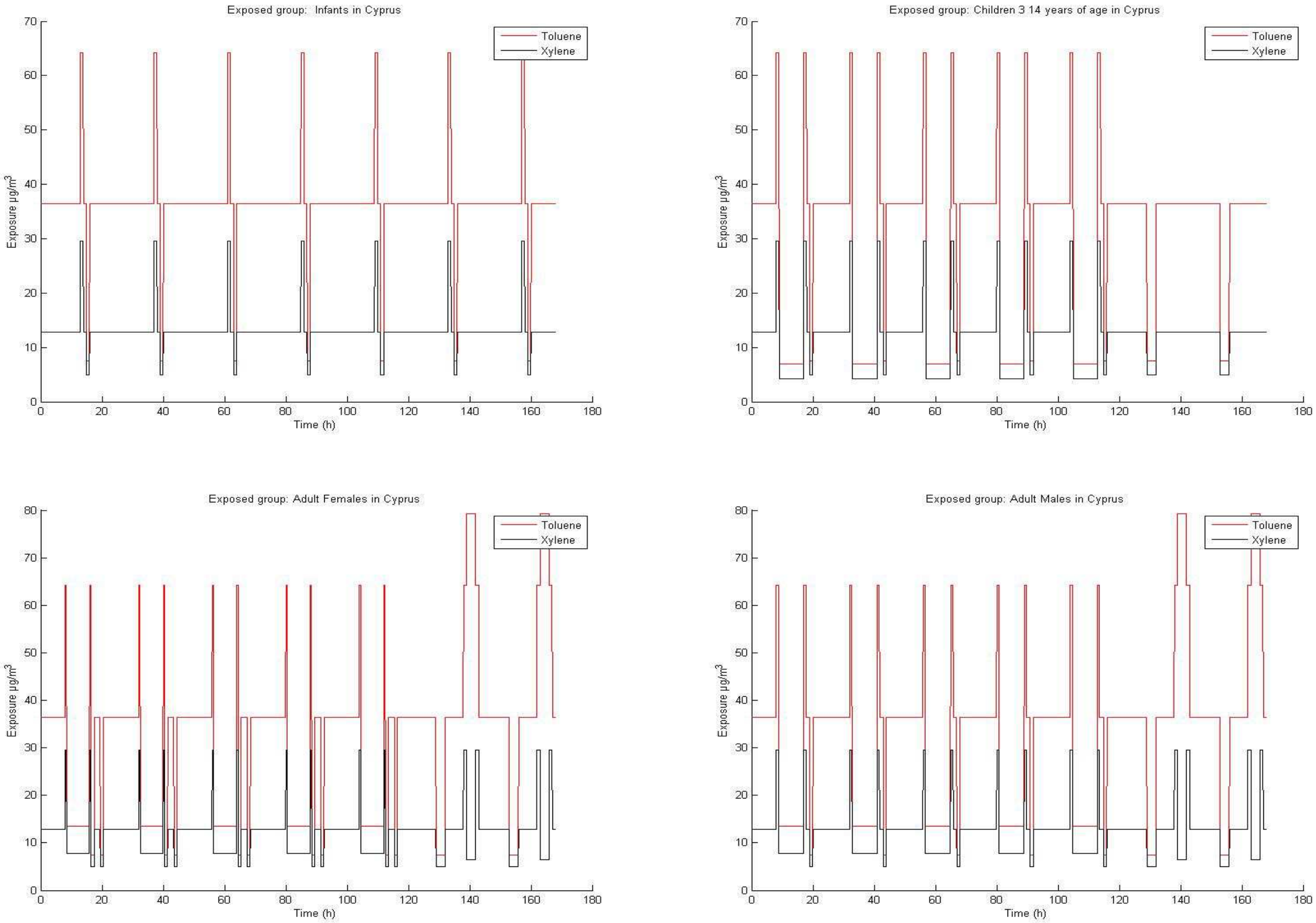


Figure 43. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Cyprus

Czech Republic

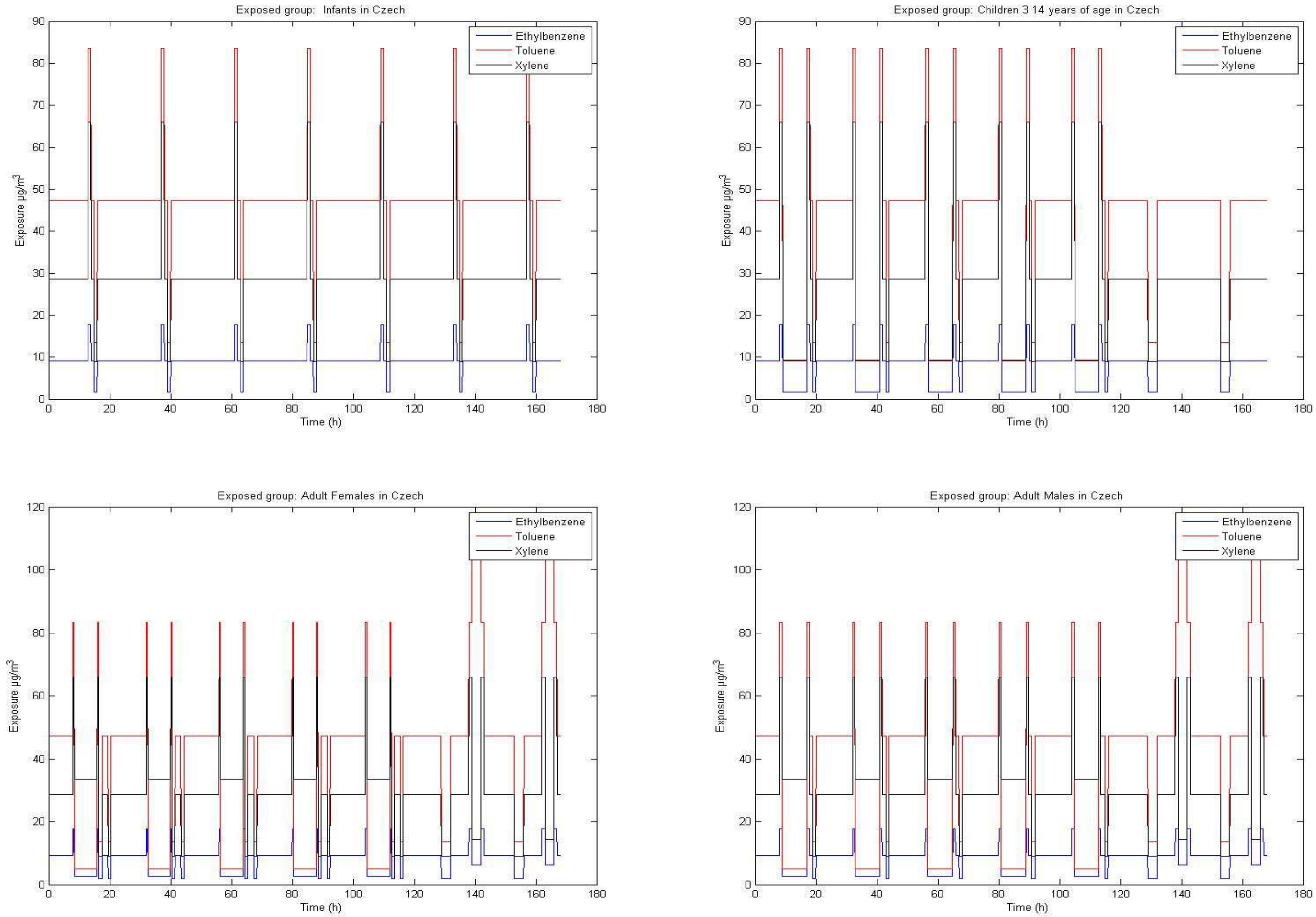


Figure 44. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Czech Republic

Finland

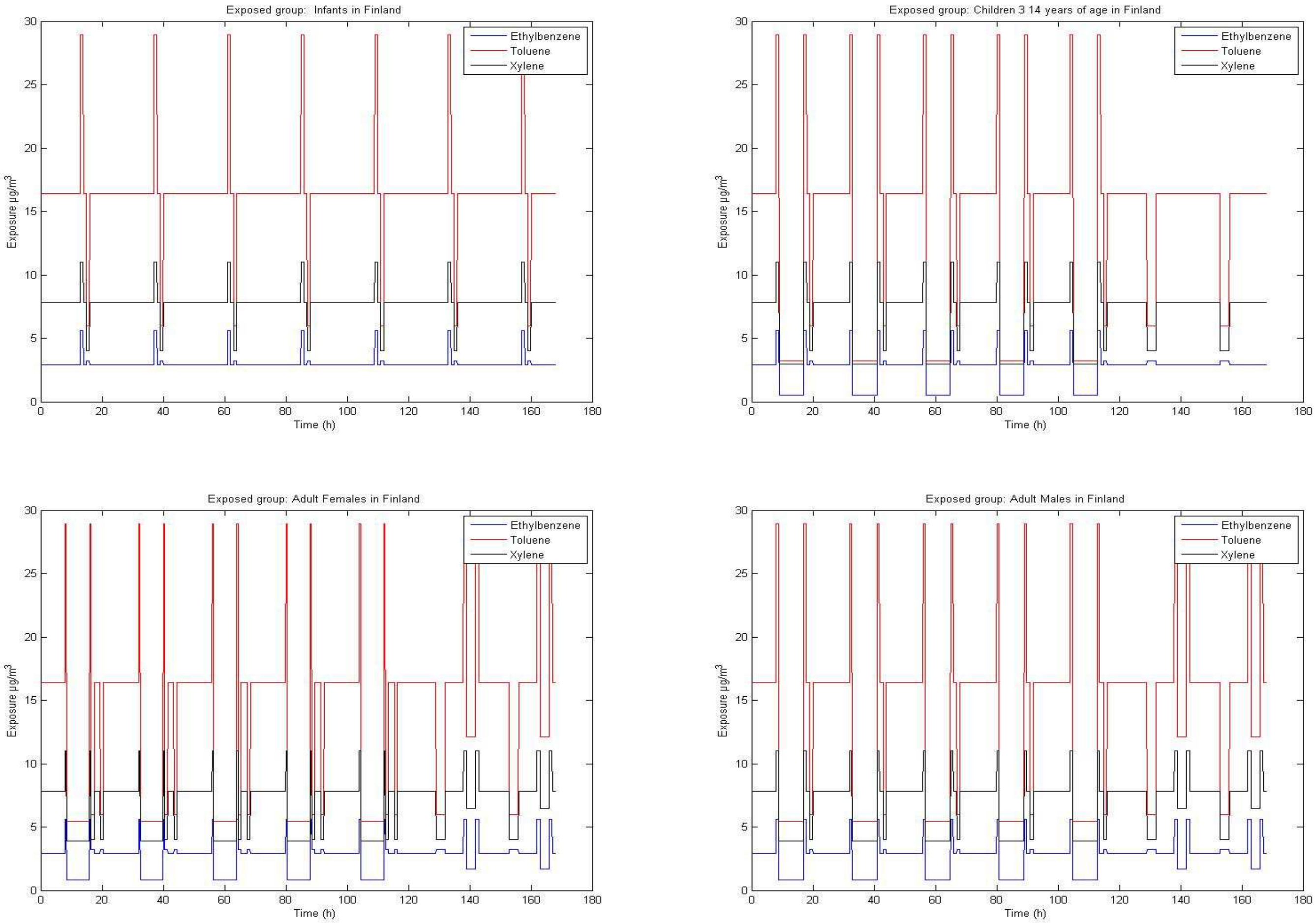


Figure 45. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Finland

France

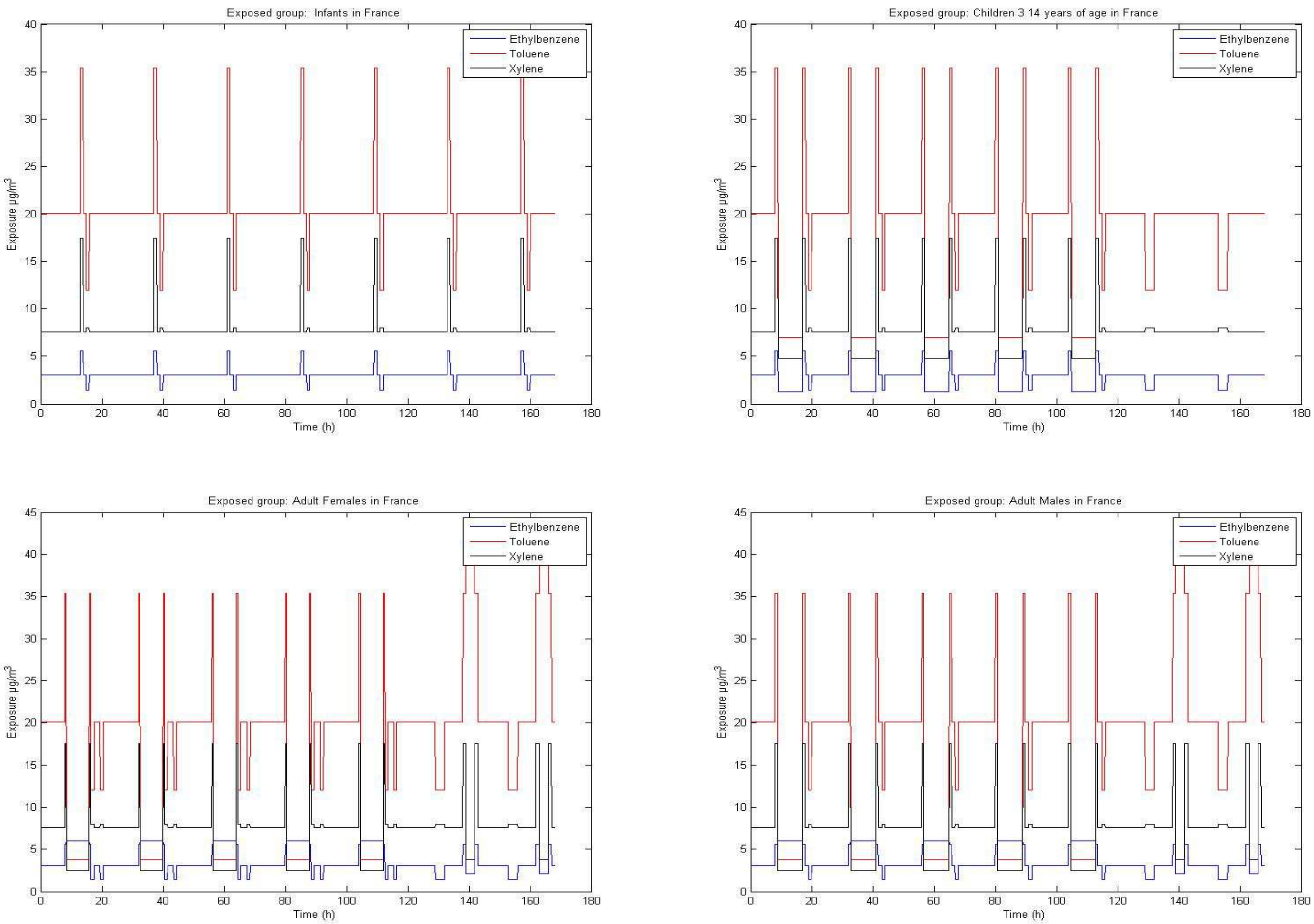


Figure 46. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in France

Germany

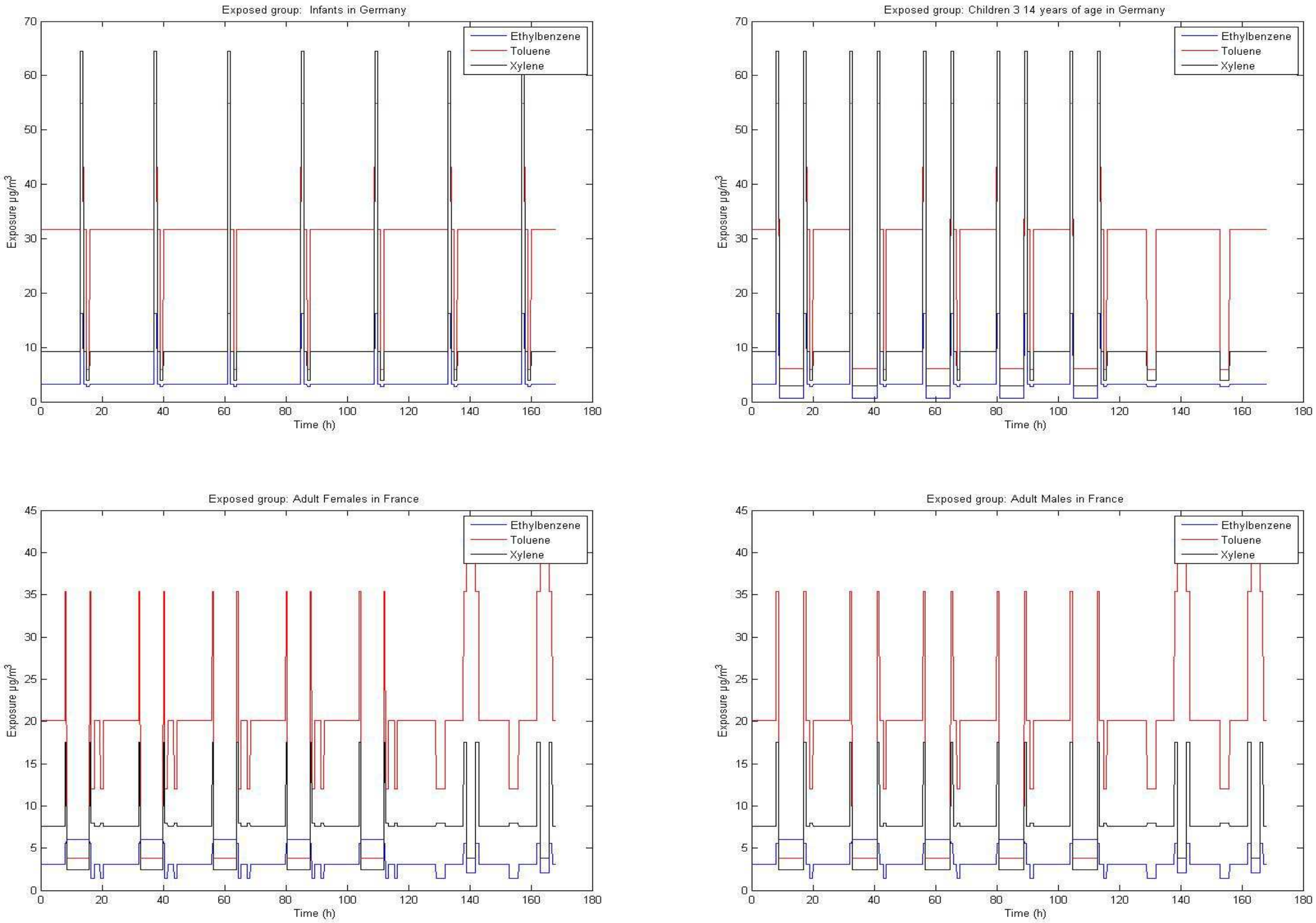


Figure 47. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Germany

Greece

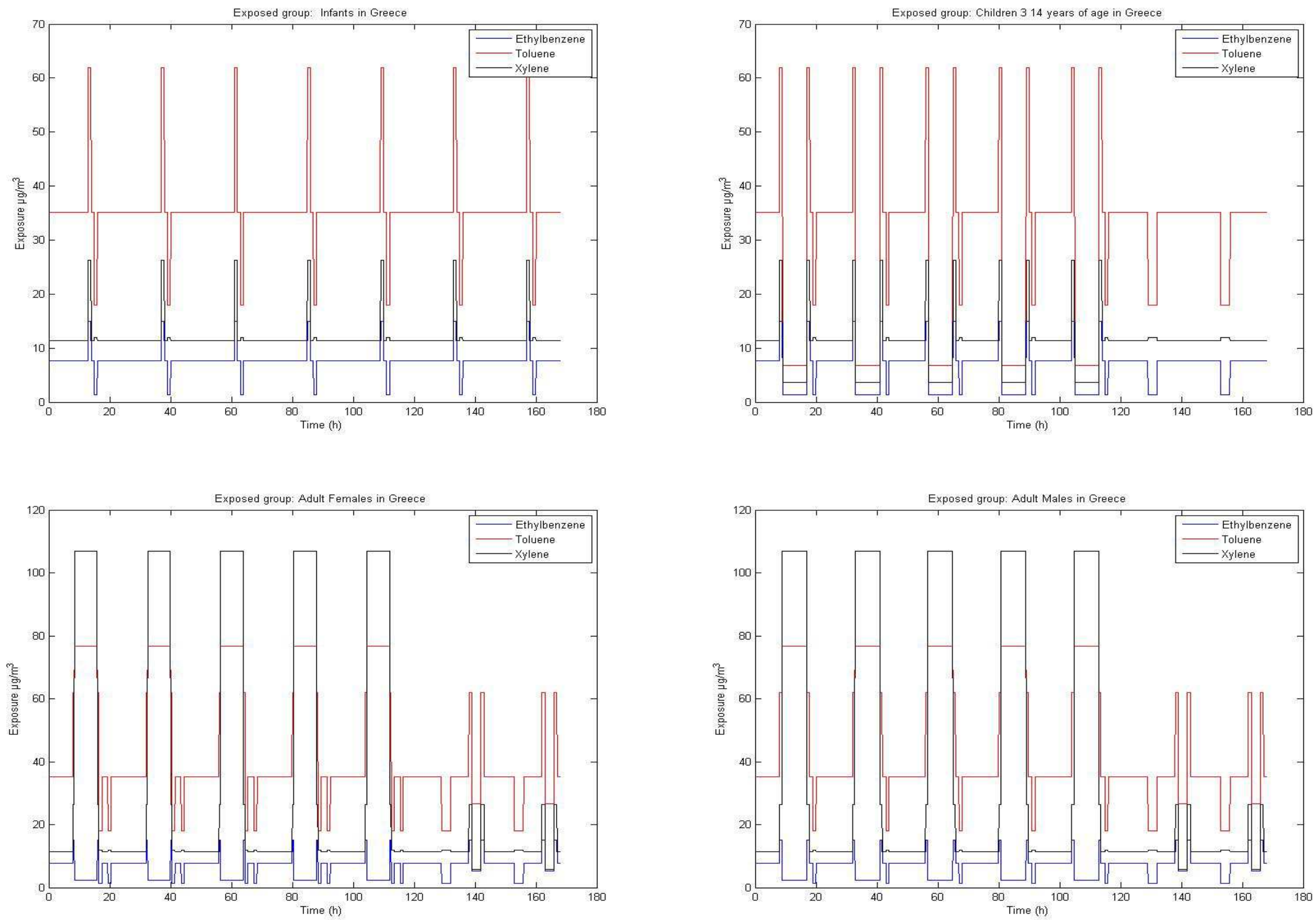


Figure 48. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Greece

Hungary

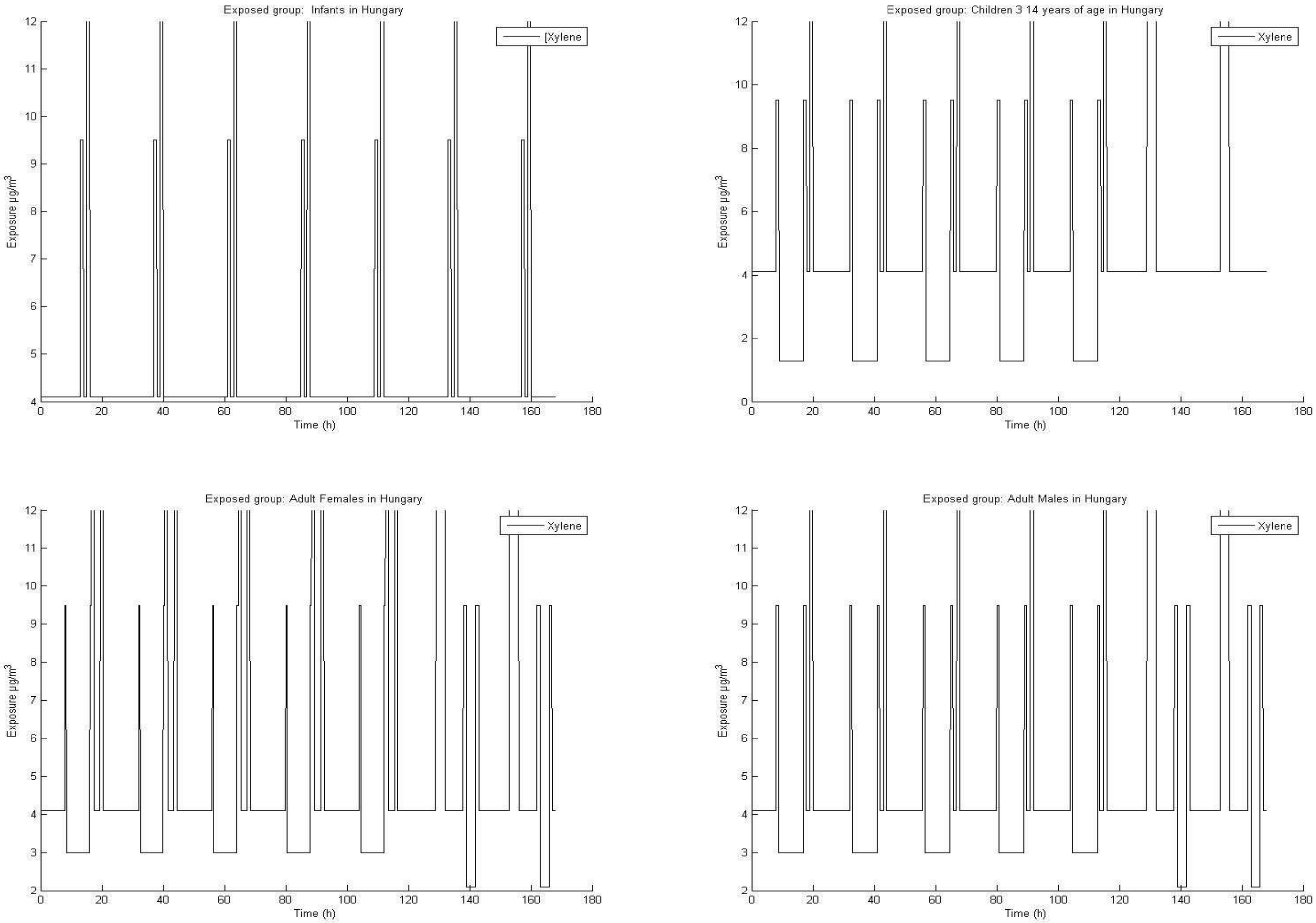


Figure 49. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Hungary

Ireland

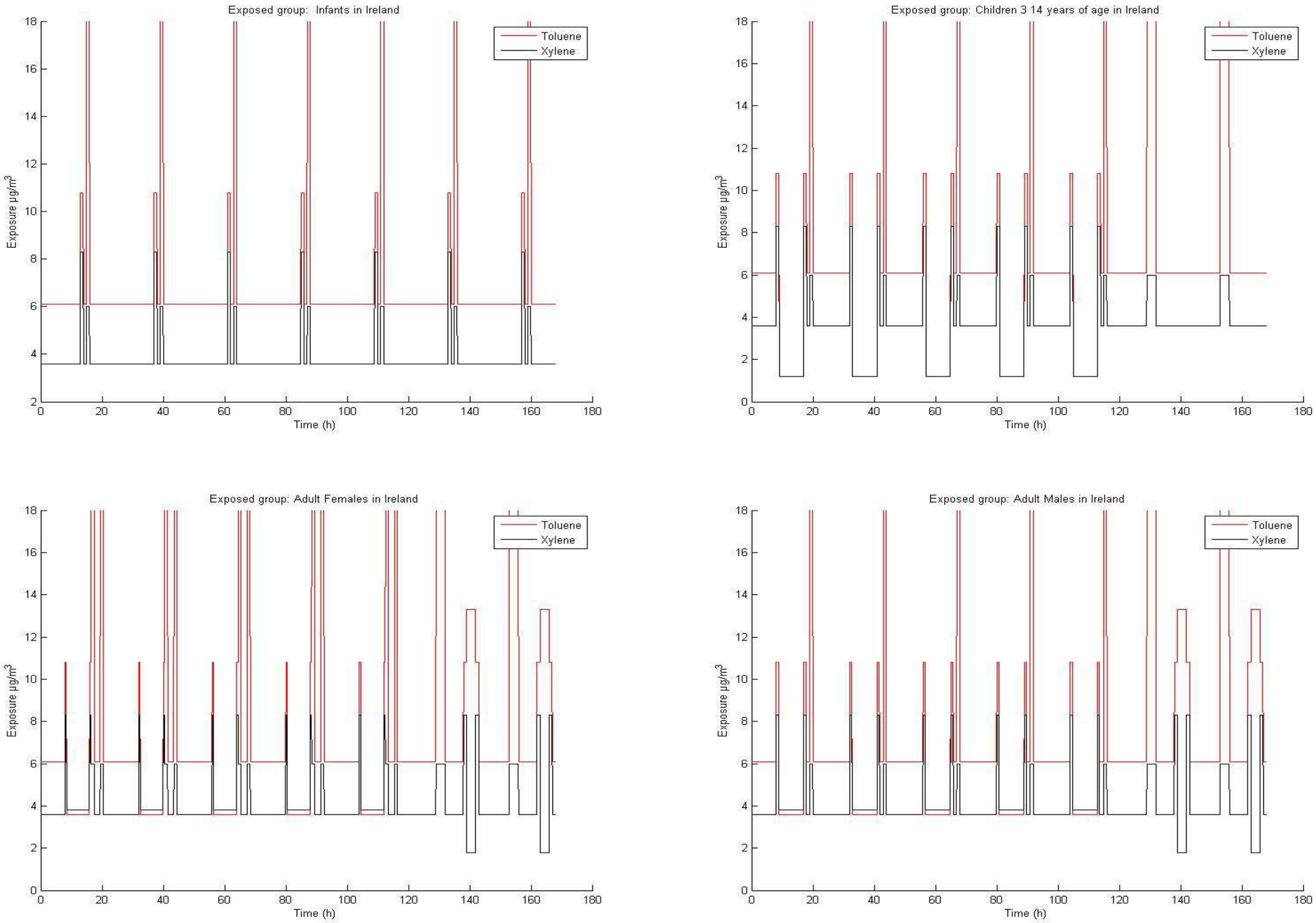


Figure 50. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Ireland

Italy

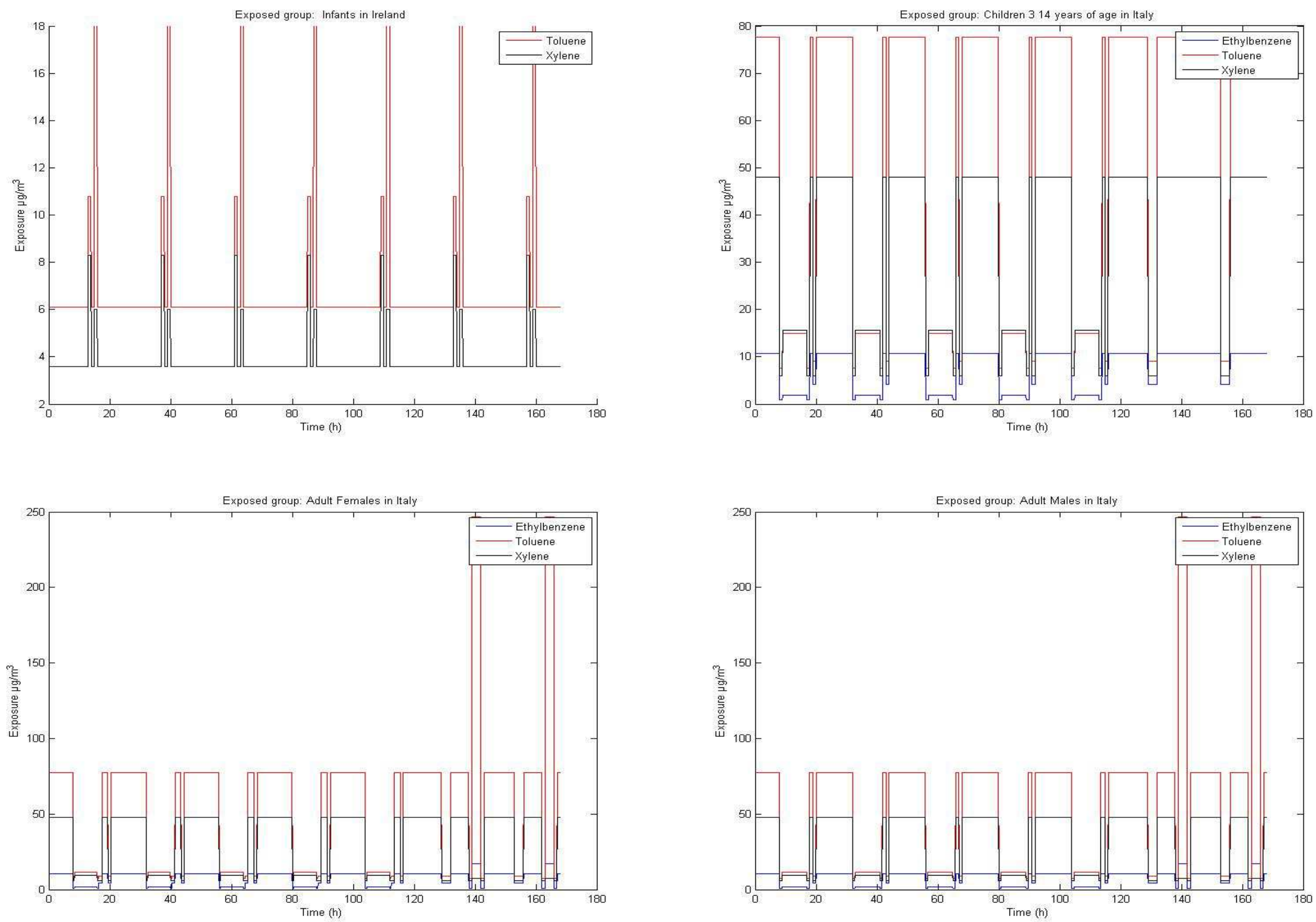


Figure 51. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Italy

Netherlands

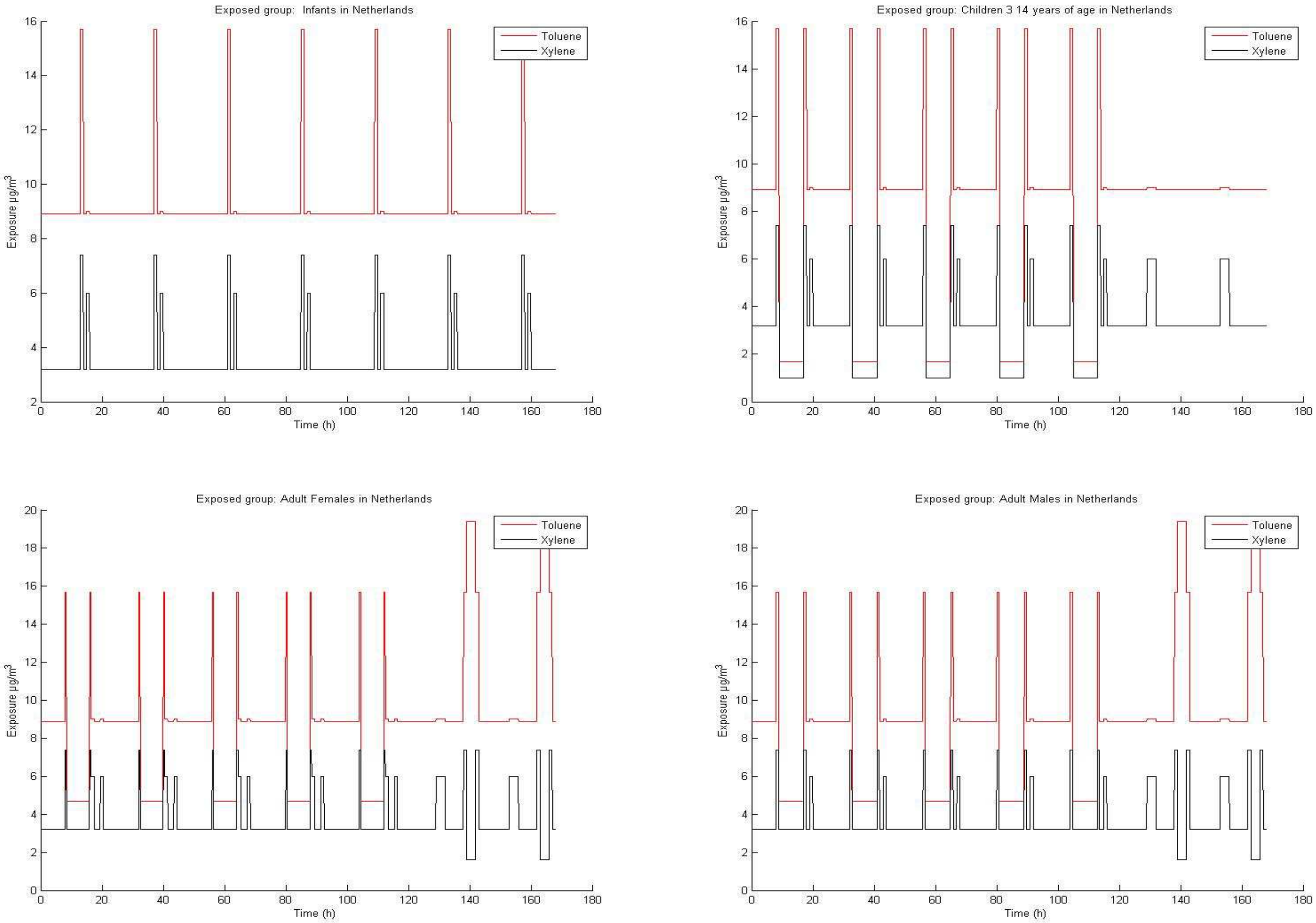


Figure 52. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Netherlands

Poland

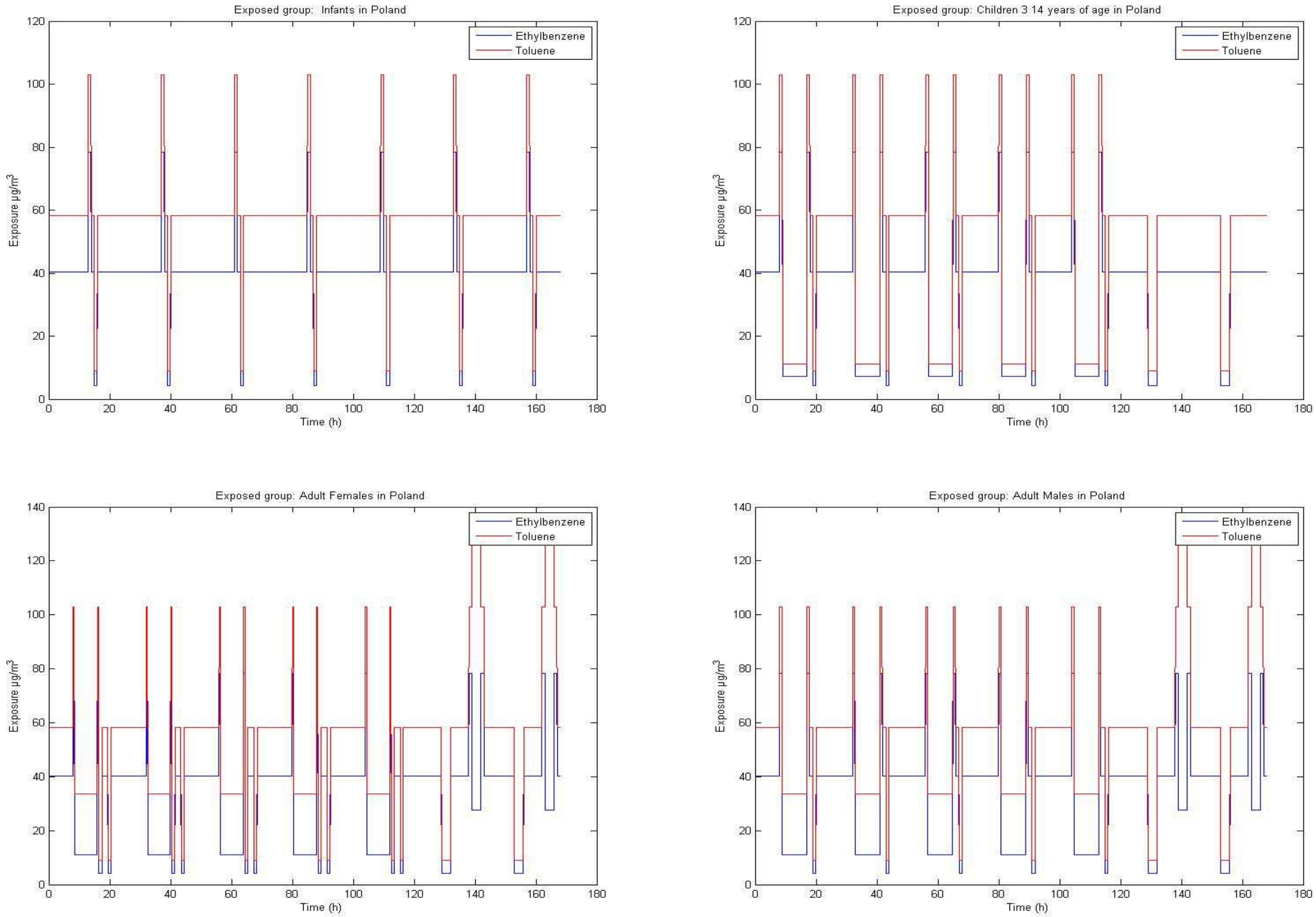


Figure 53. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Poland

Poland

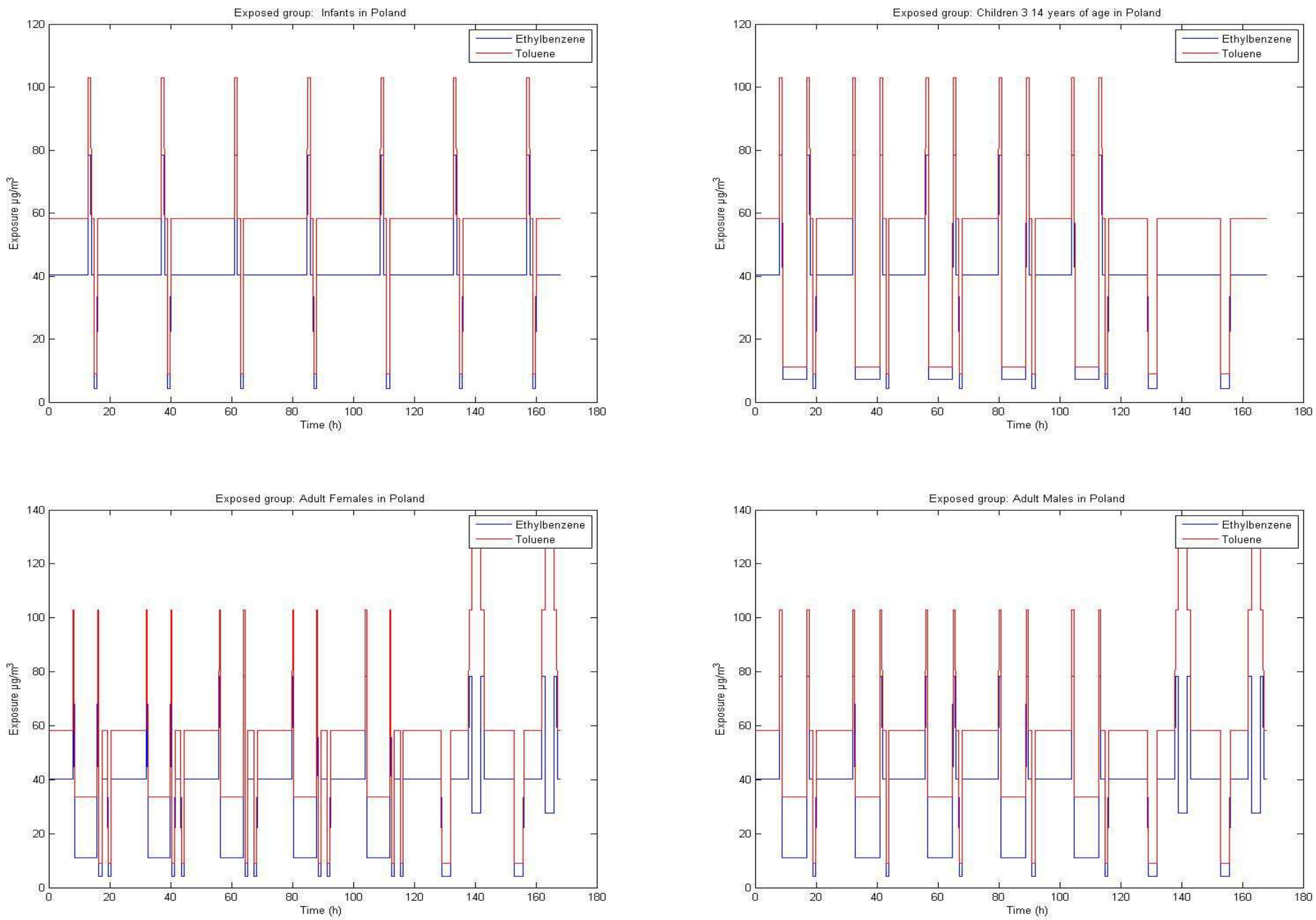
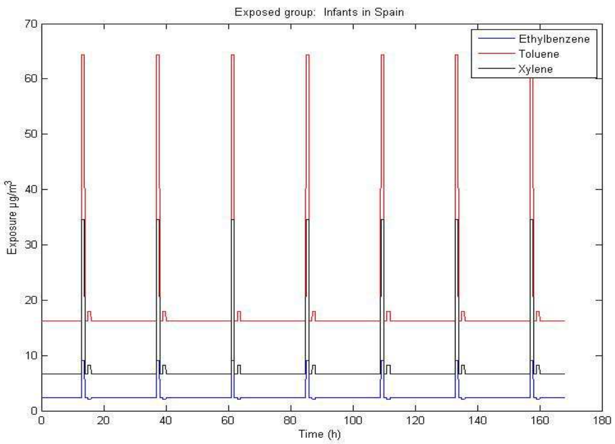
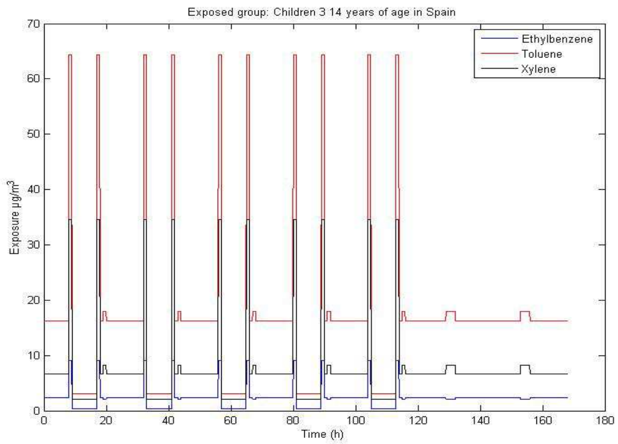
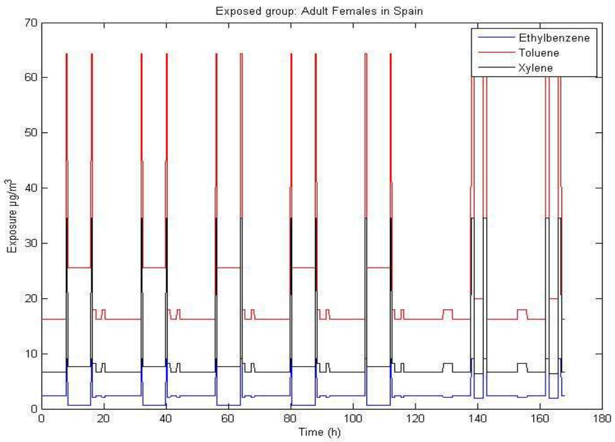


Figure 54. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Poland

Spain


Exposed group: Infants in Spain
Ethylbenzene
Toluene
Xylene
Exposure µg/m3
Time (h)


Exposed group: Children 3 14 years of age in Spain
Ethylbenzene
Toluene
Xylene
Exposure µg/m3
Time (h)



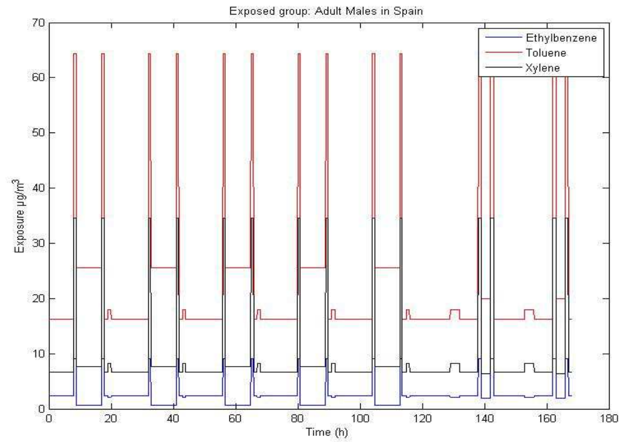
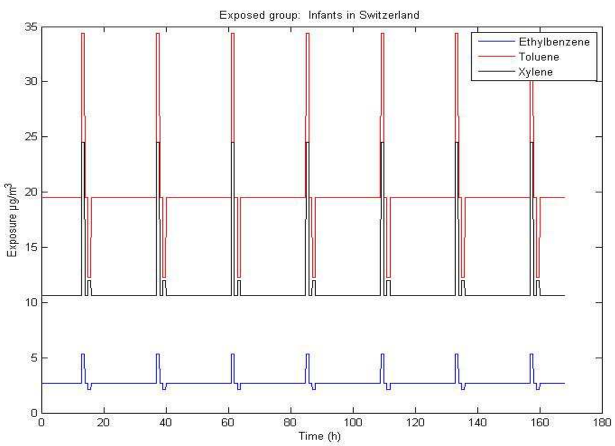
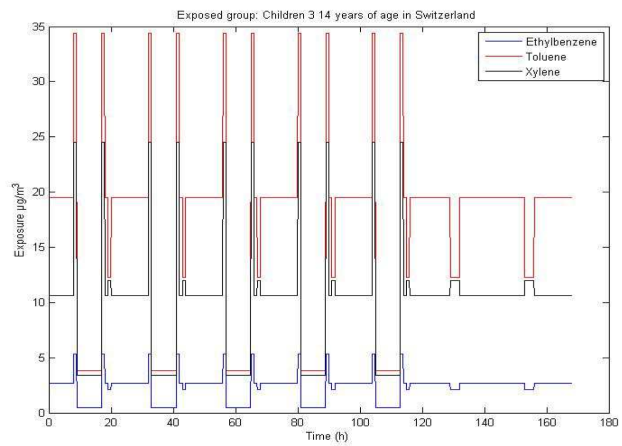


Figure 55. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Spain

Switzerland





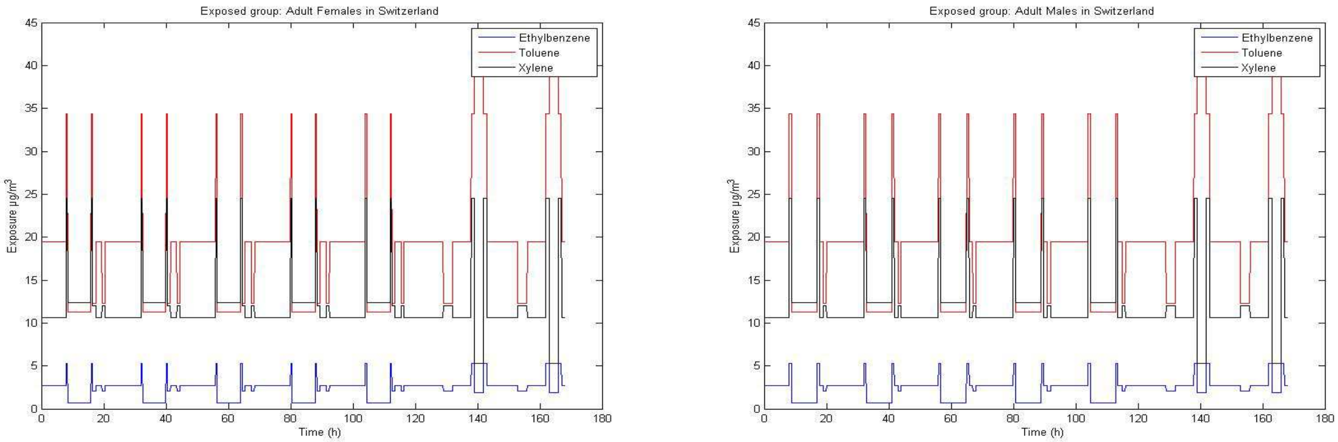


Figure 56. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in Switzerland

UK

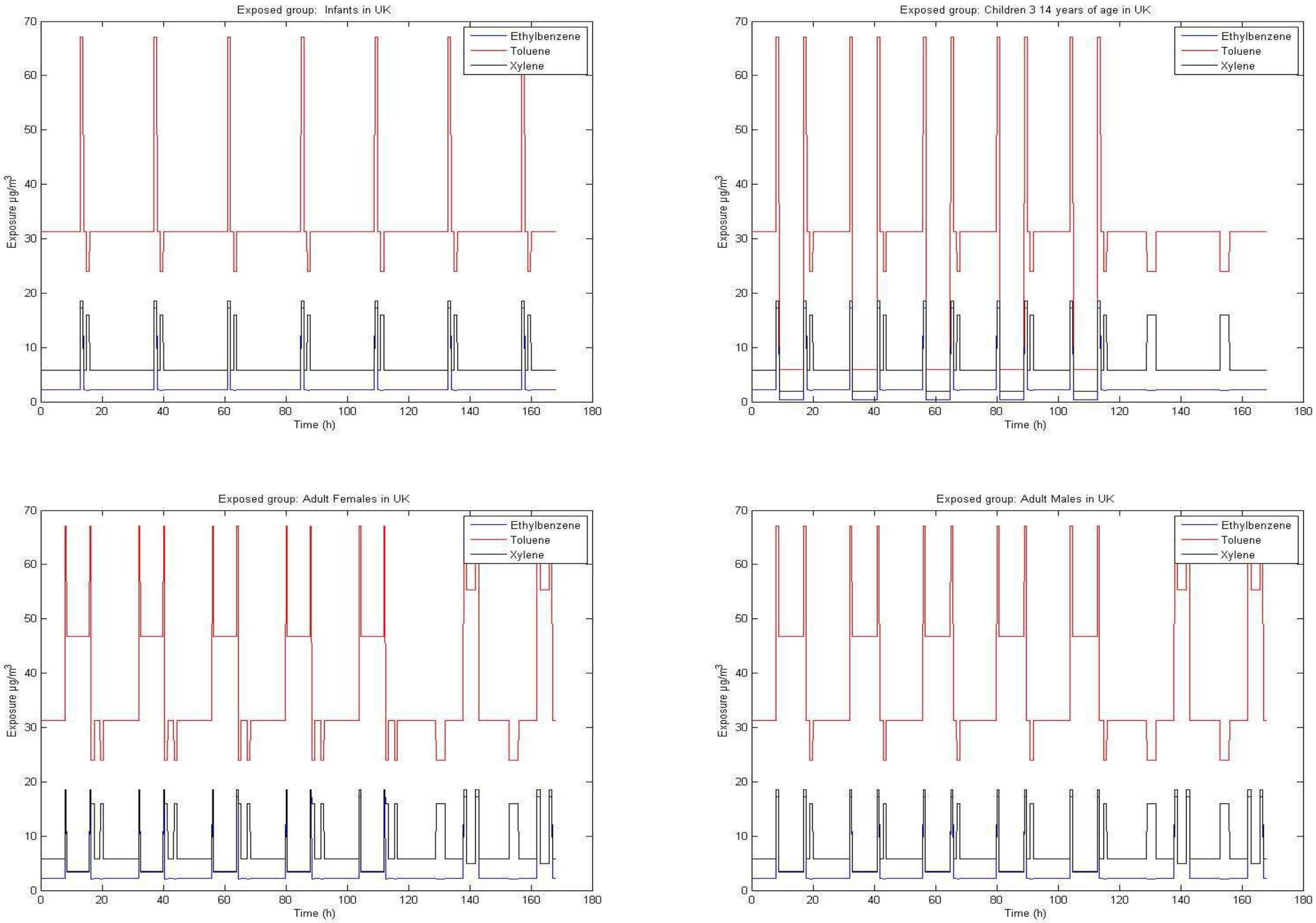
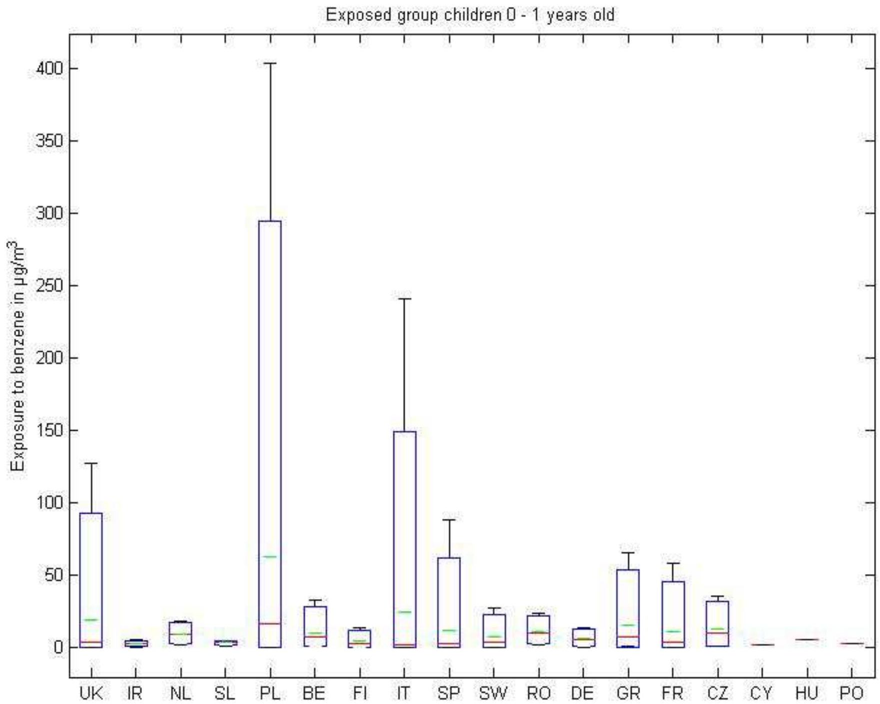


Figure 57. Toluene, ethylbenzene and xylenes exposure diurnal variability for a representative week for all population groups in UK

Appendix 7 - Exposure and uptake to BTEX in the EU

Infants



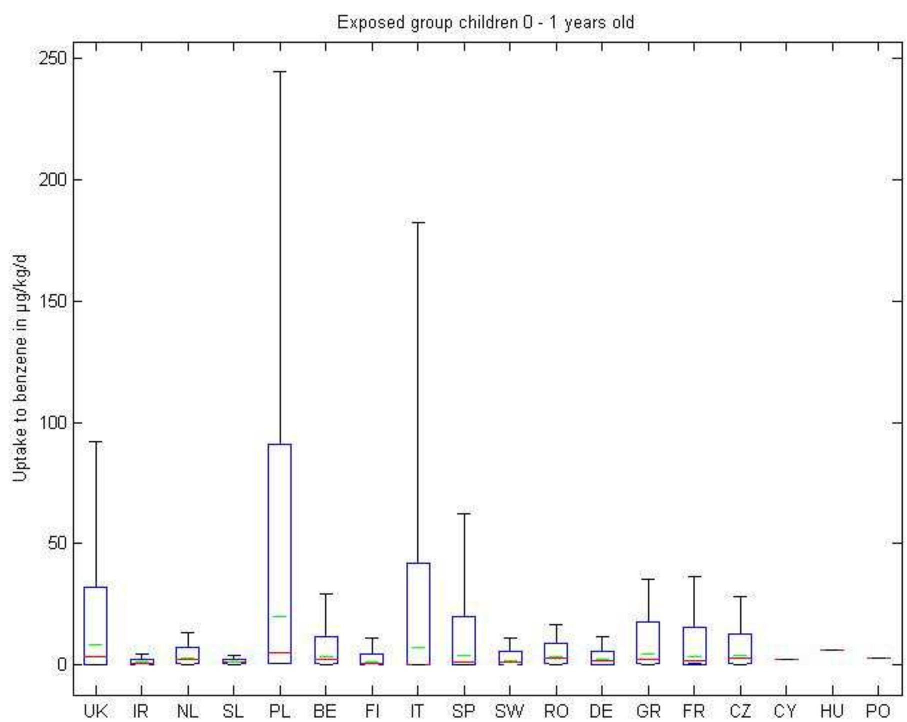


Figure 58. Whisker plots for benzene exposure and uptake for infants

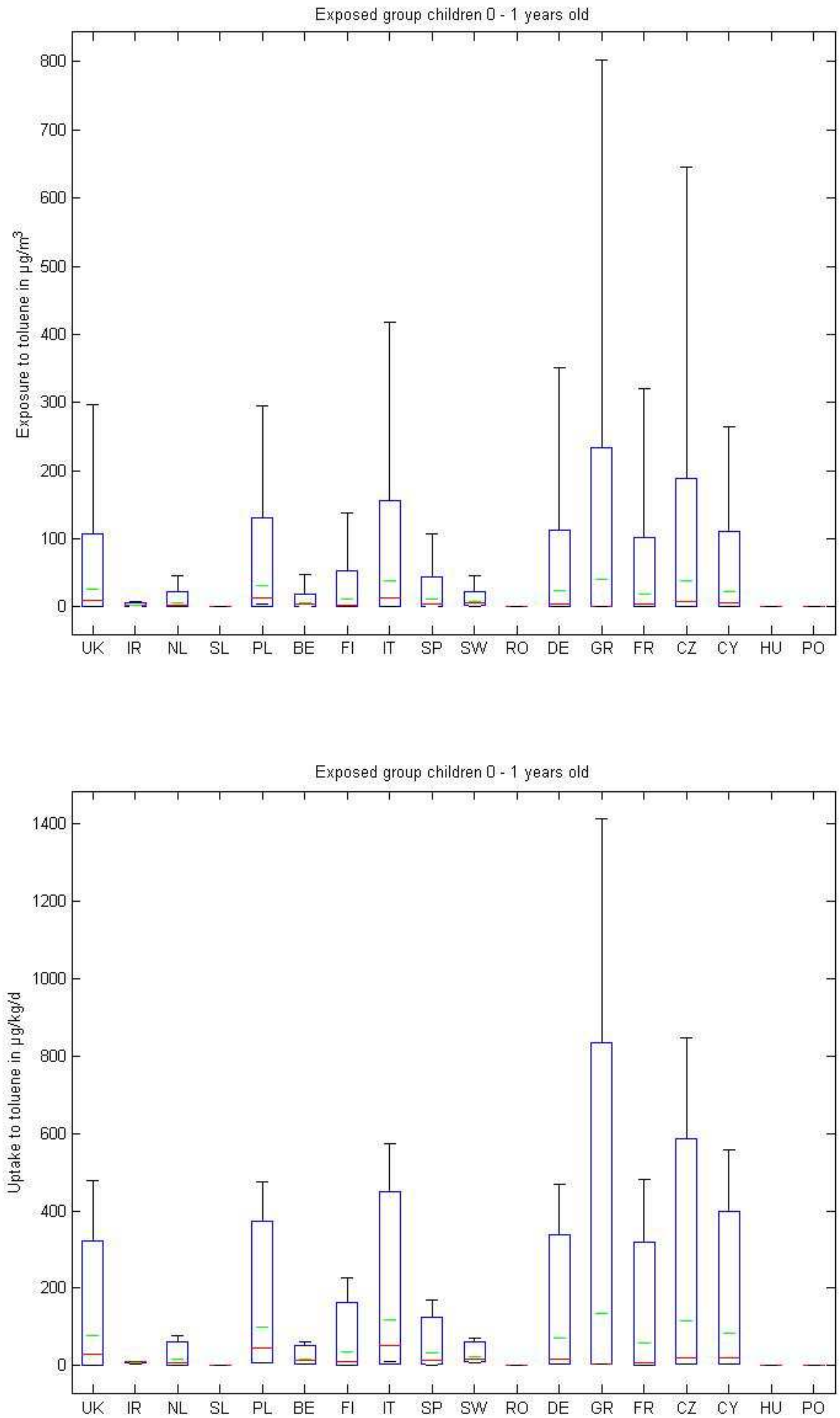
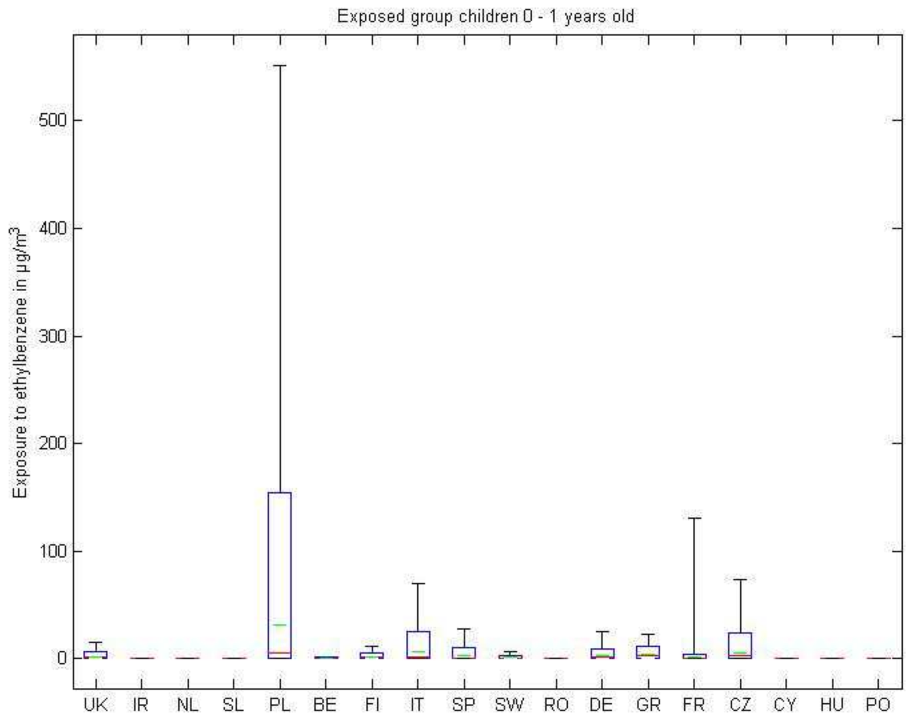


Figure 59. Whisker plot for toluene exposure and uptake for infants



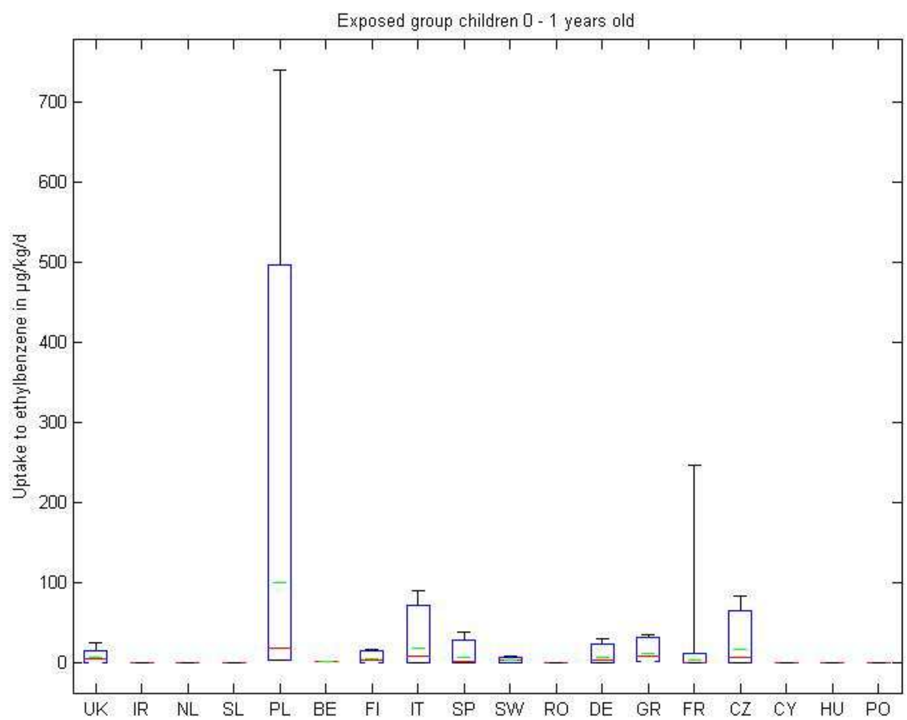
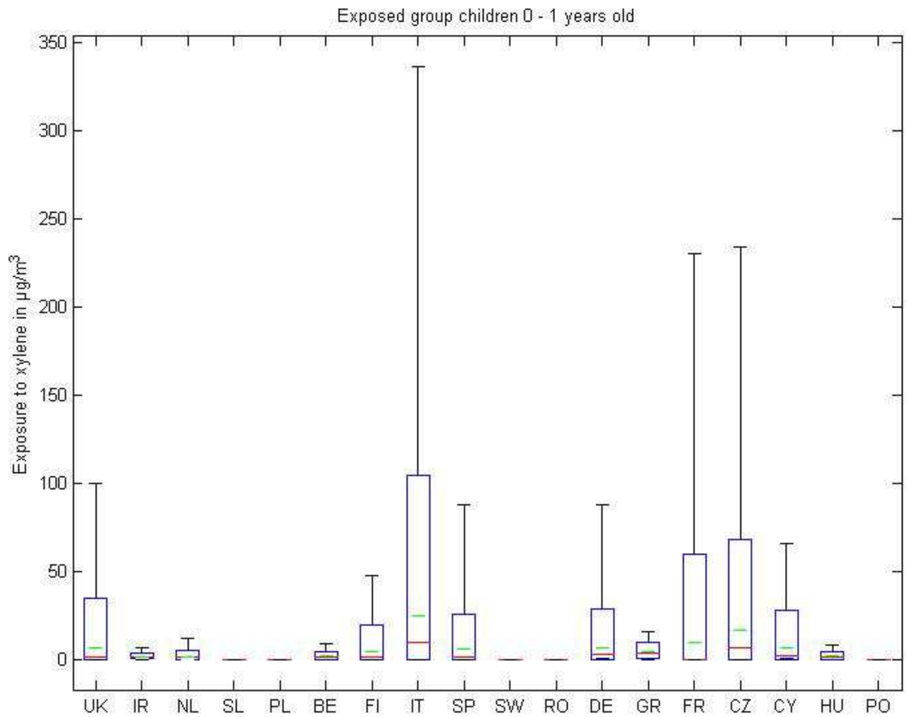


Figure 60. Whisker plot for ethyl-benzene exposure and uptake for infants



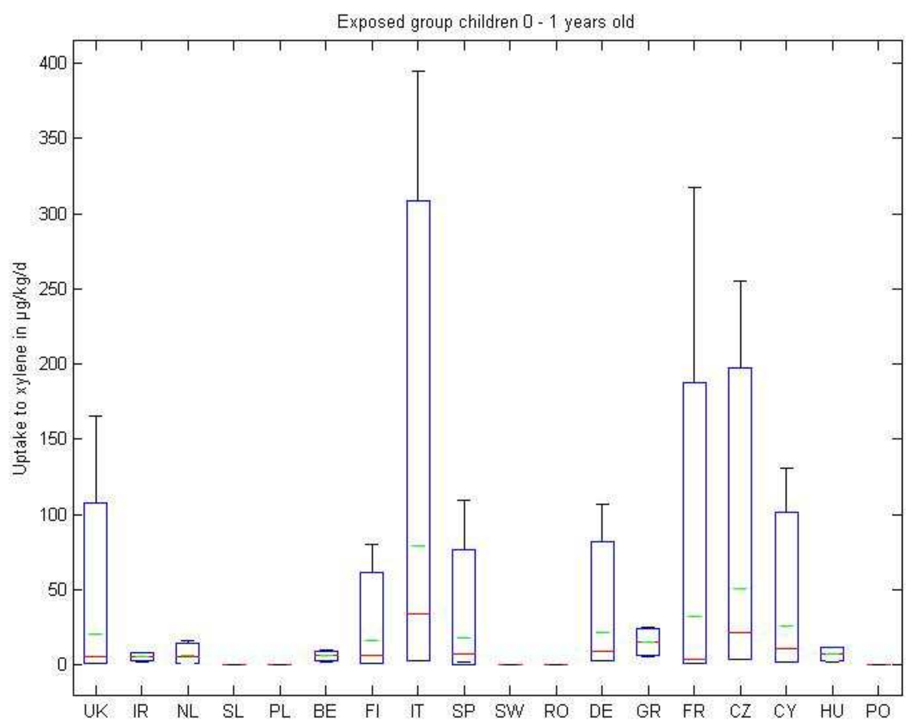


Figure 61. Whisker plot for xylenes exposure and uptake for infants

Children aged 3 to 14

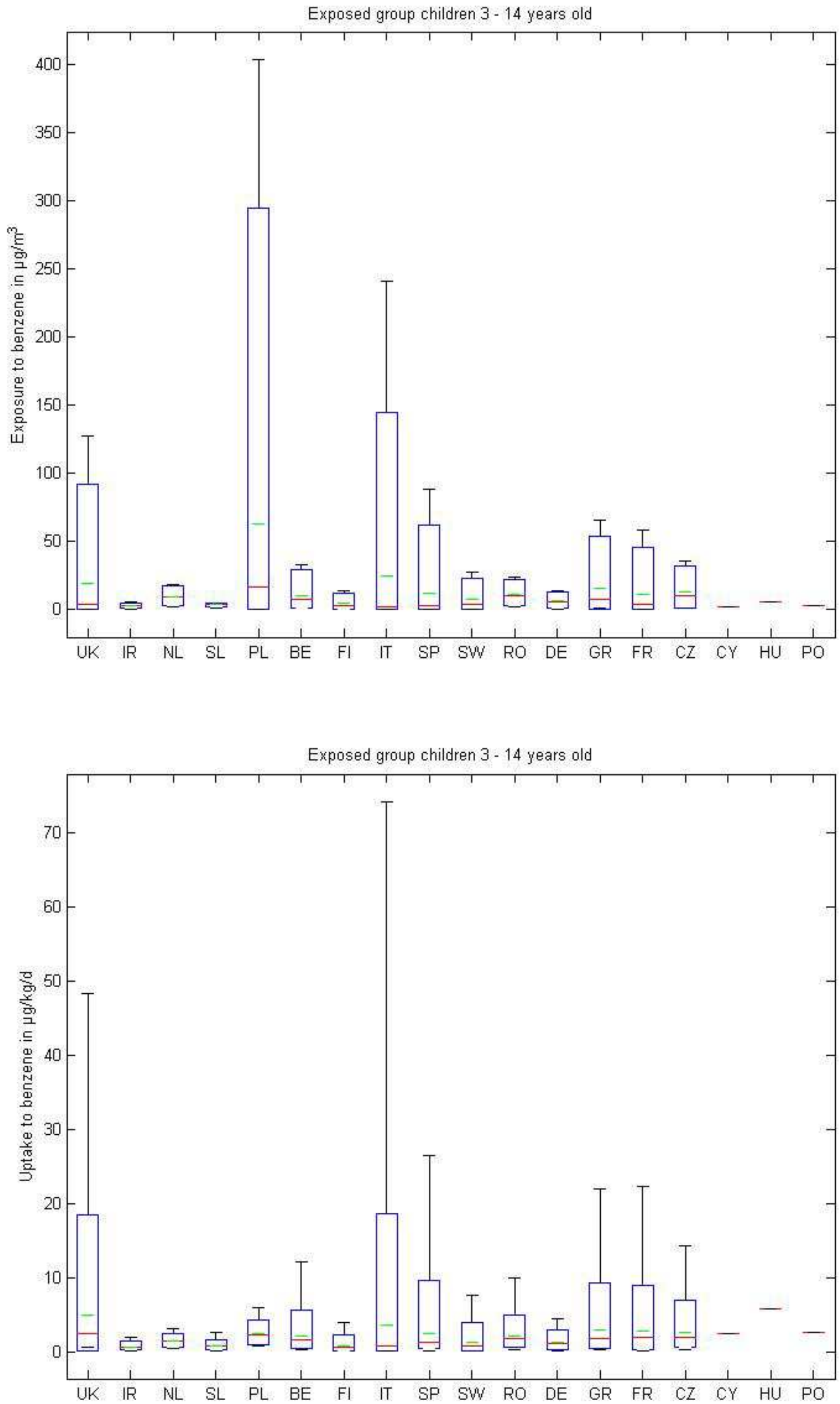
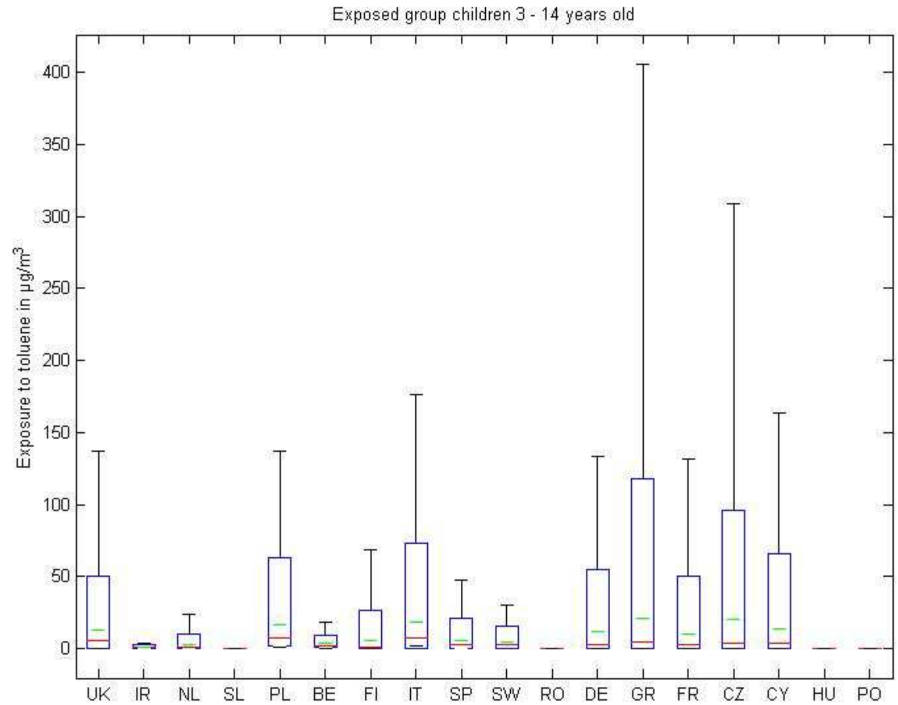


Figure 62. Whisker plots for benzene exposure and uptake, for children aged 3 to 14.



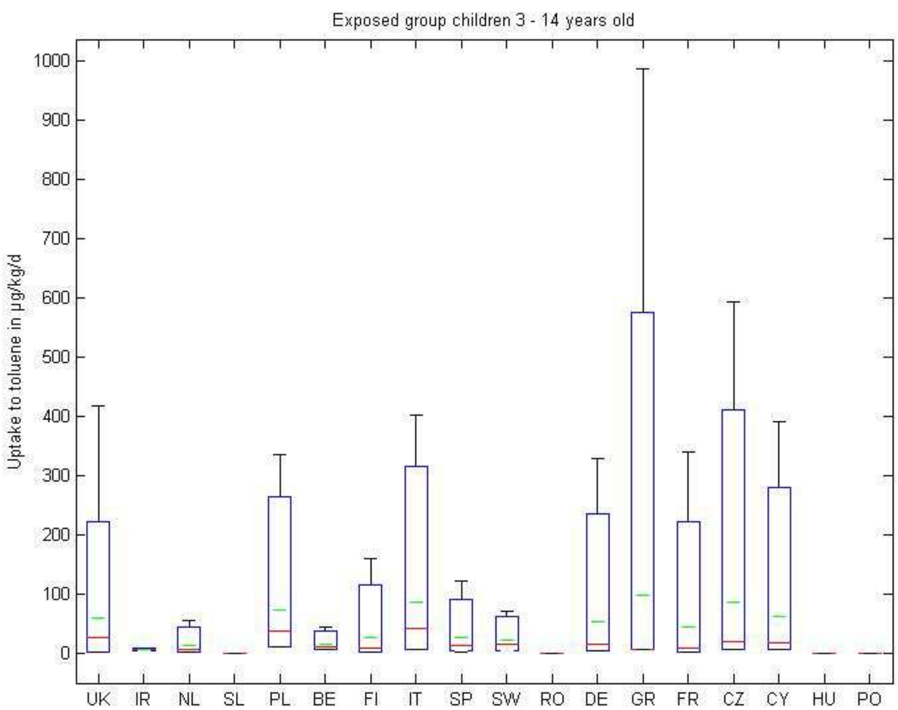


Figure 63. Whisker plots for toluene exposure and uptake, for children aged 3 to 14

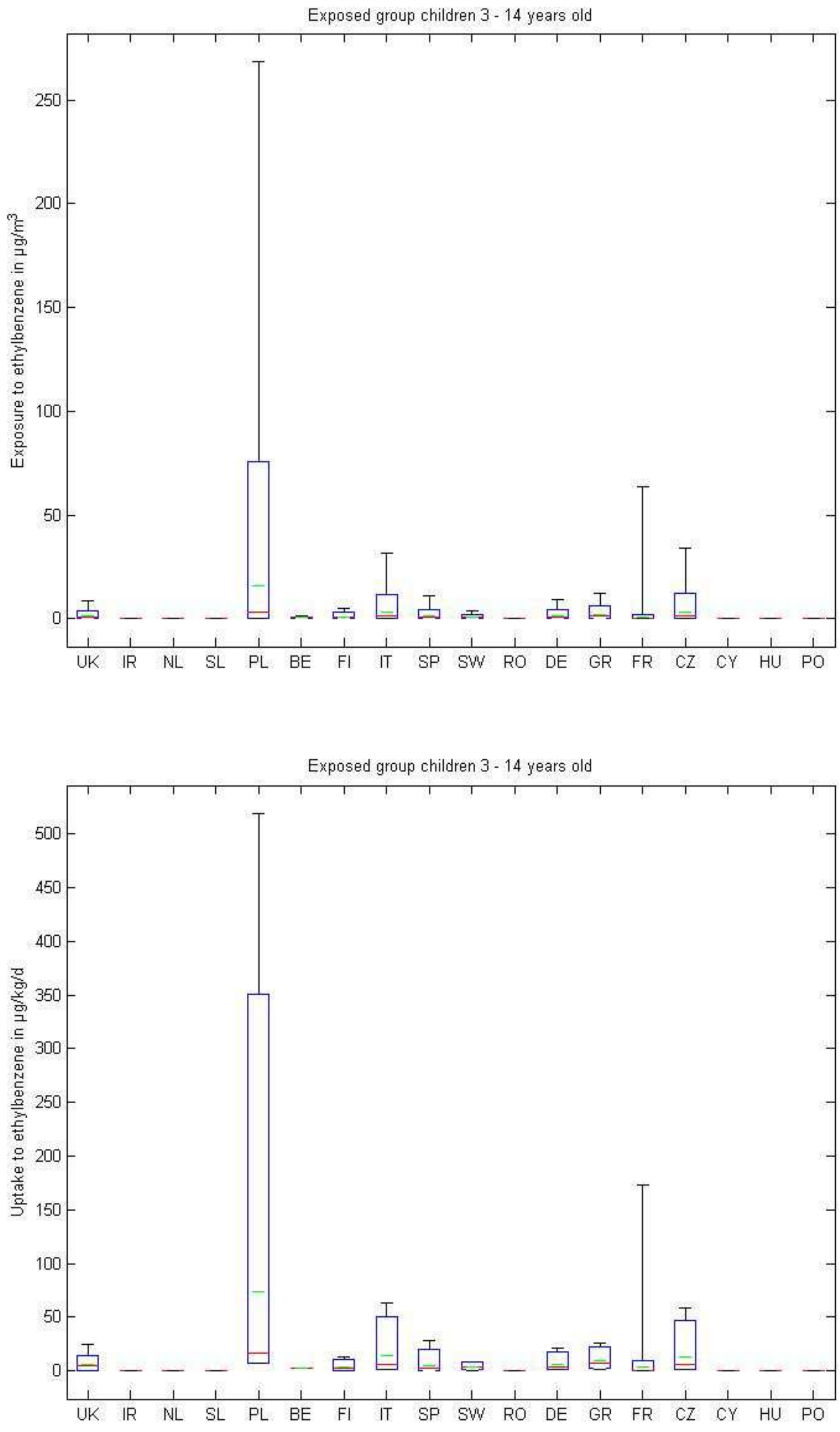
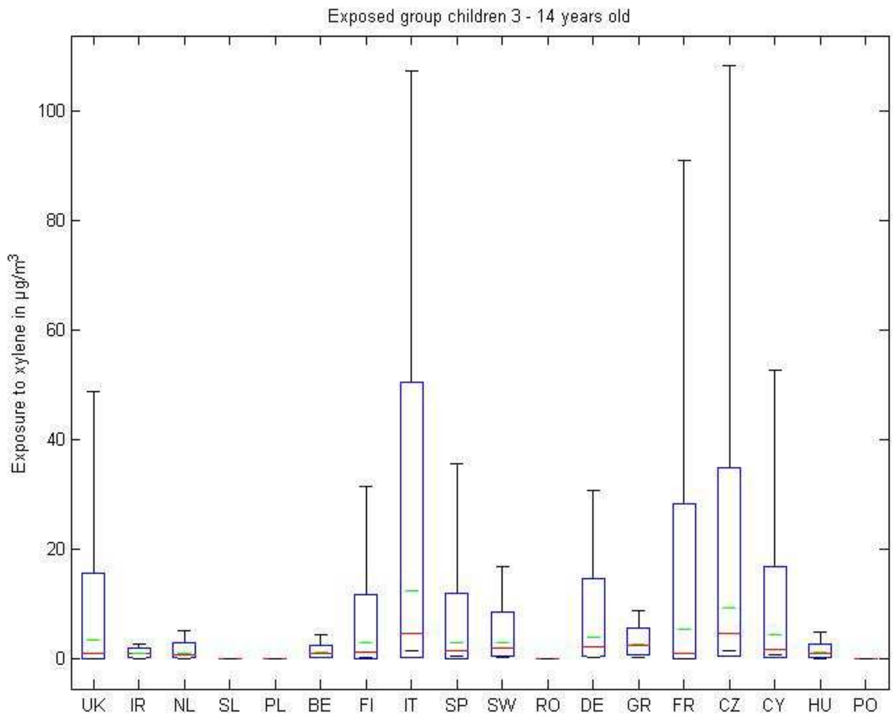


Figure 64. Whisker plots for ethylbenzene exposure and uptake, for children aged 3 to 14



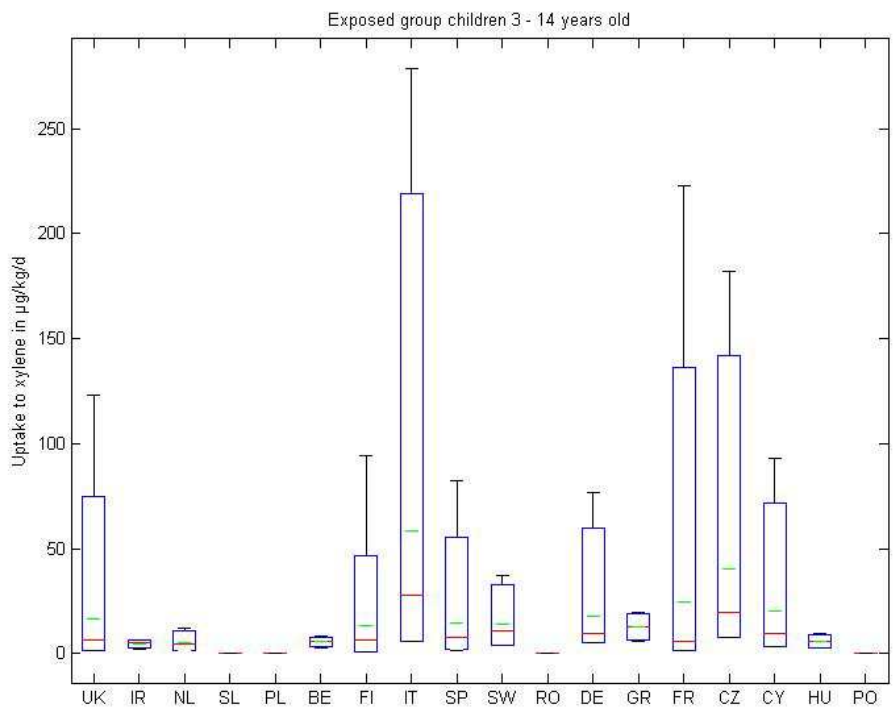


Figure 65. Whisker plots for xylene exposure and uptake, for children aged 3 to 14

Adult females

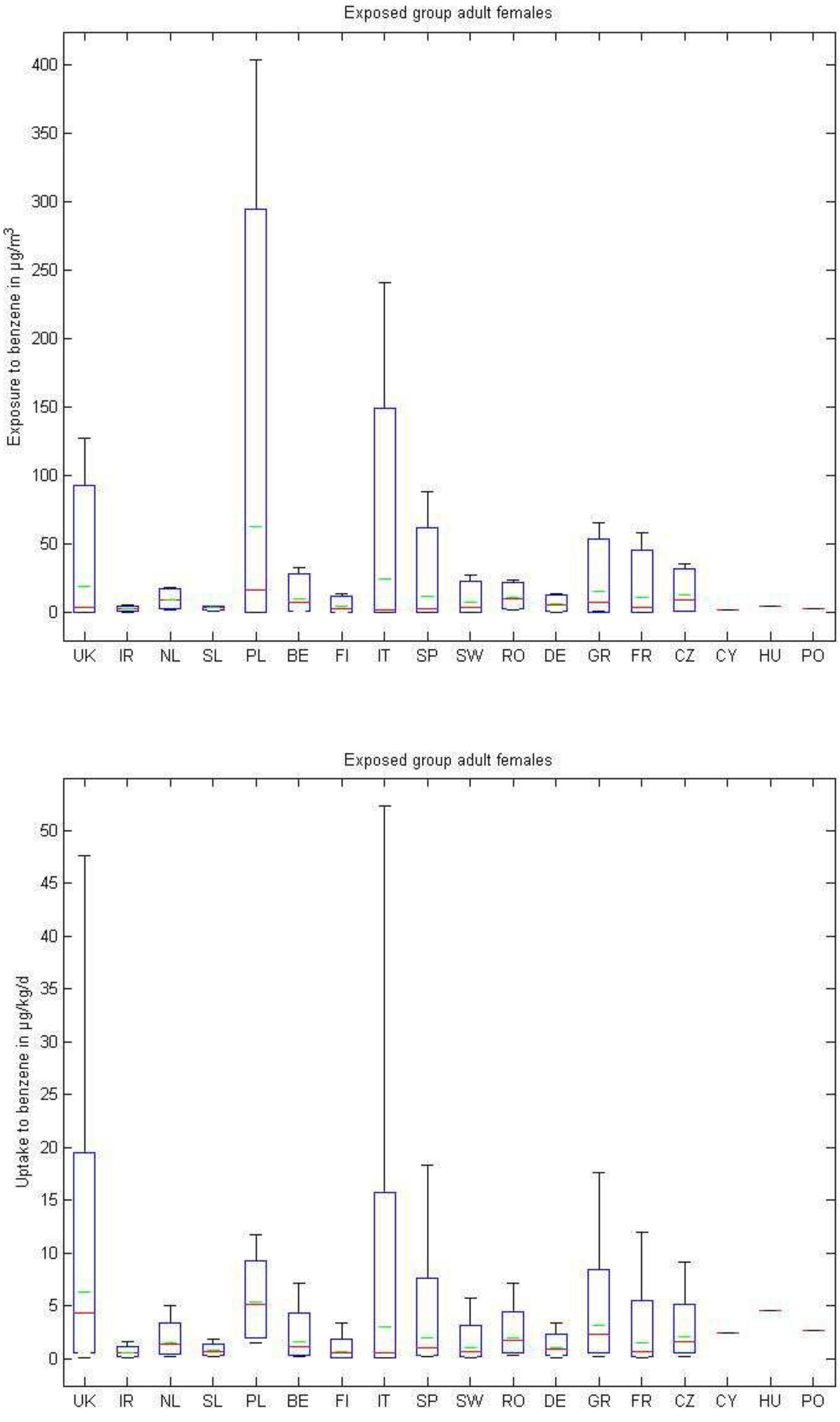
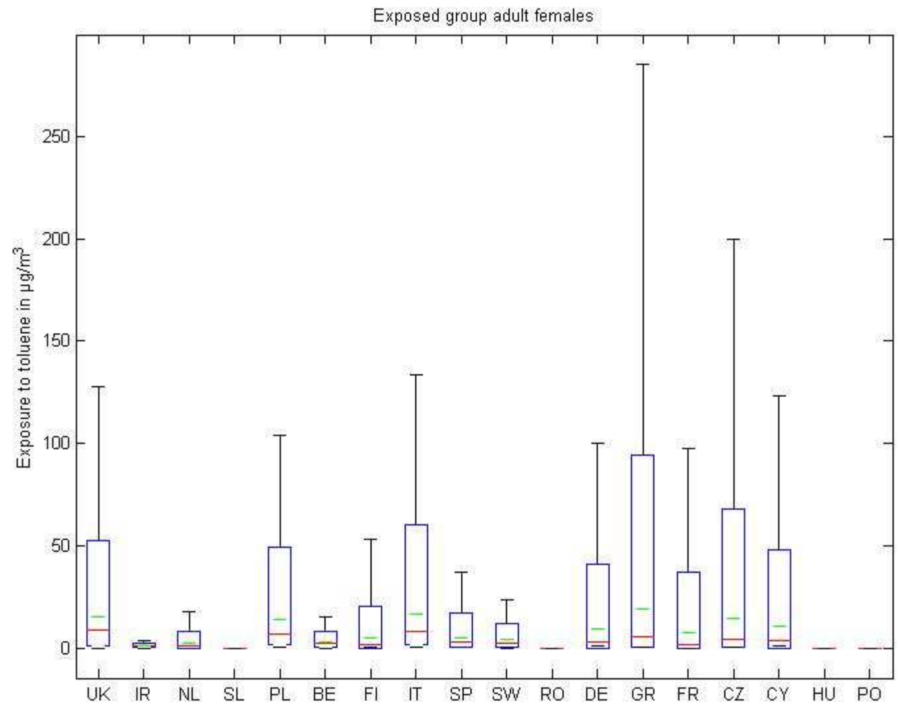


Figure 66. Whisker plots for benzene exposure and uptake, for adult females



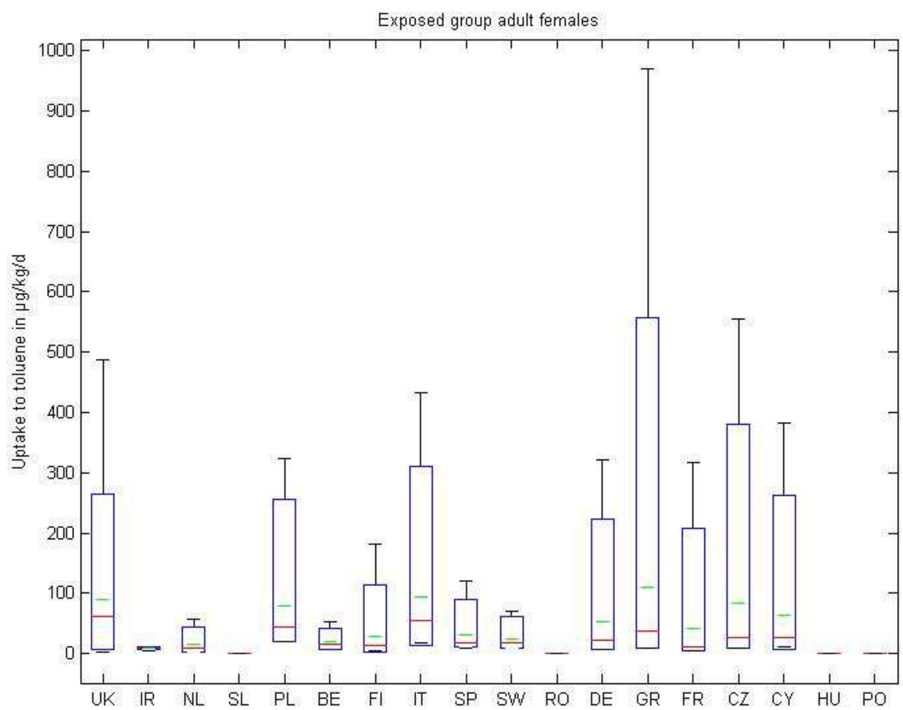
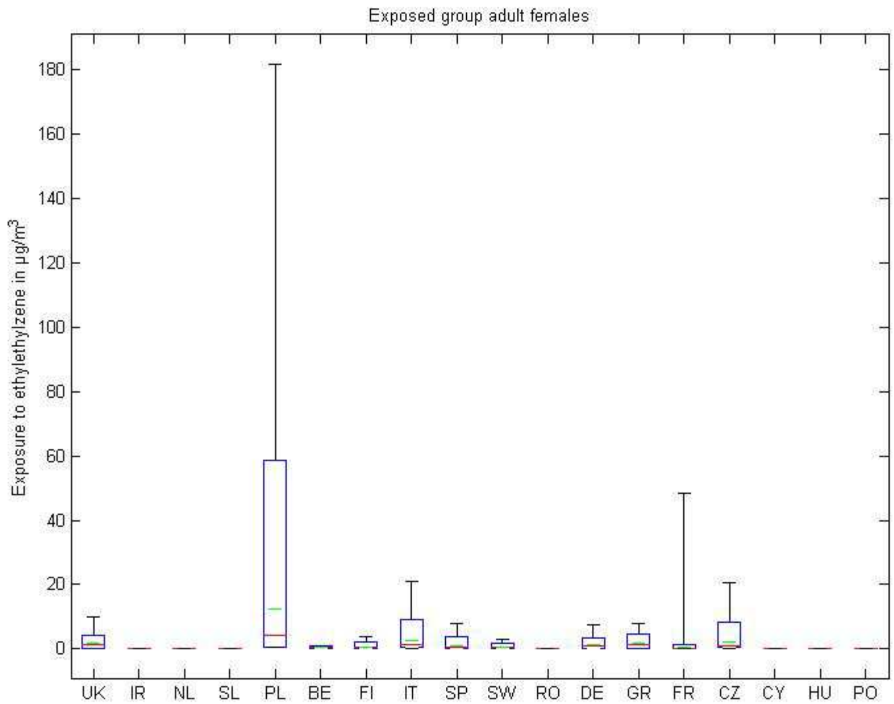


Figure 67. Whisker plots for toluene exposure and uptake, for adult females



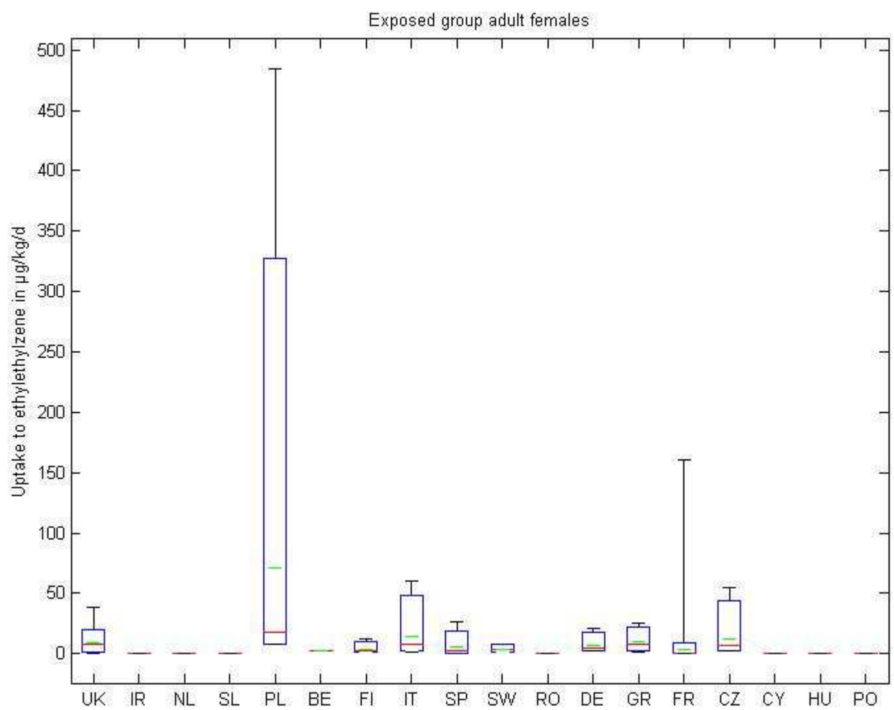


Figure 68. Whisker plots for ethylebenzene exposure and uptake, for adult females

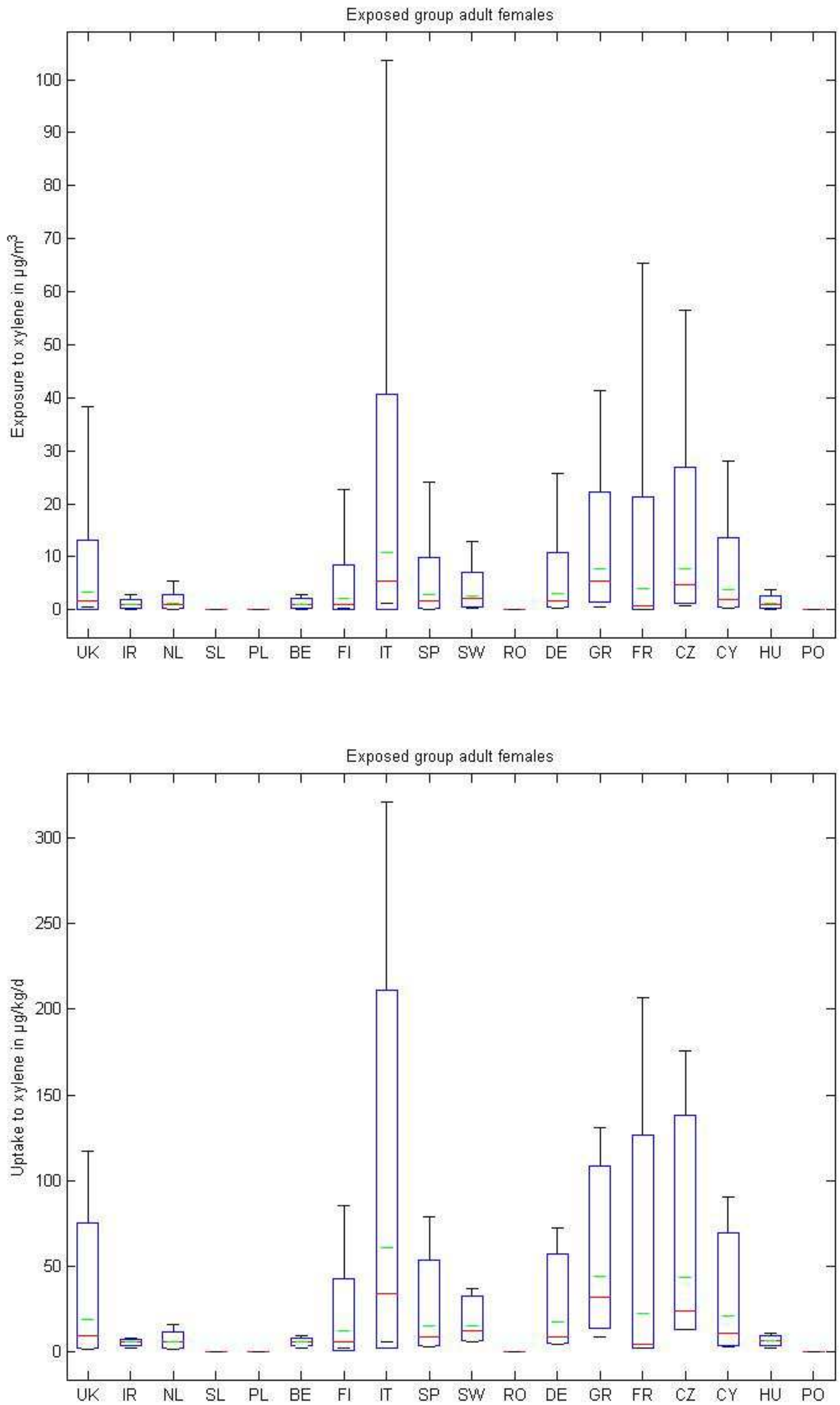


Figure 69. Whisker plots for xylene exposure and uptake, for adult females

Exposed group: adult males

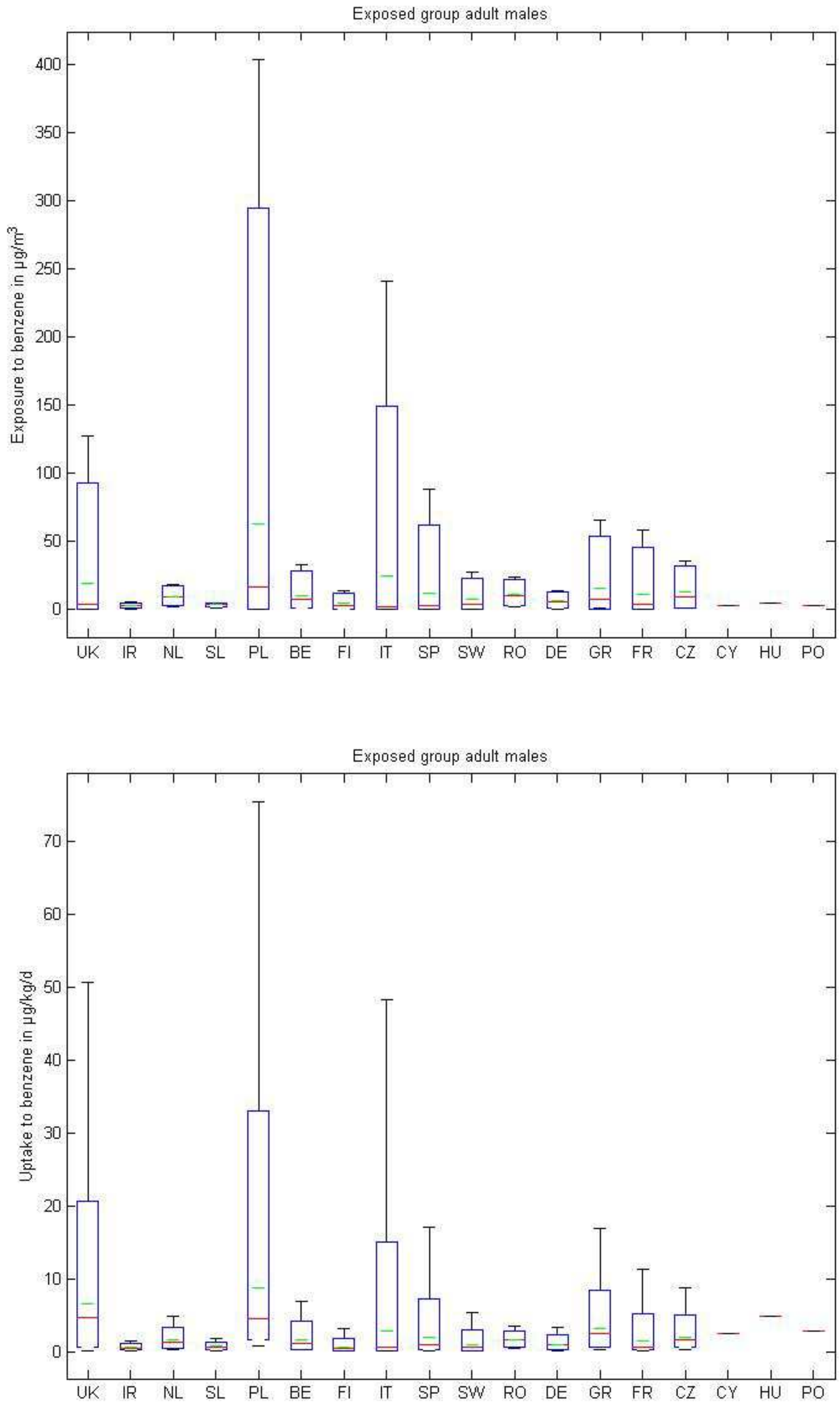


Figure 70. Whisker plots for benzene exposure and uptake, for adult males

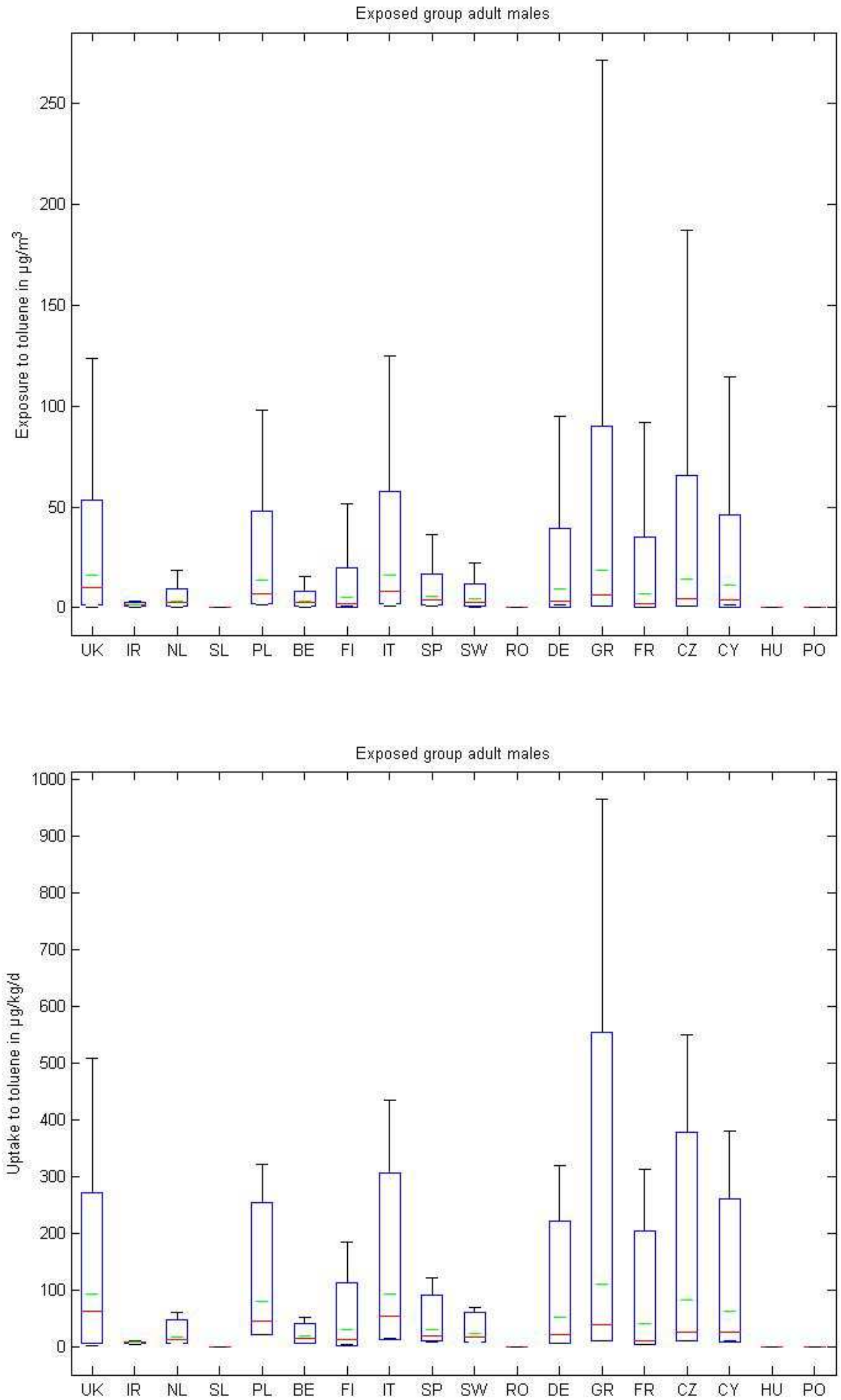


Figure 71. Whisker plots for toluene exposure and uptake, for adult males

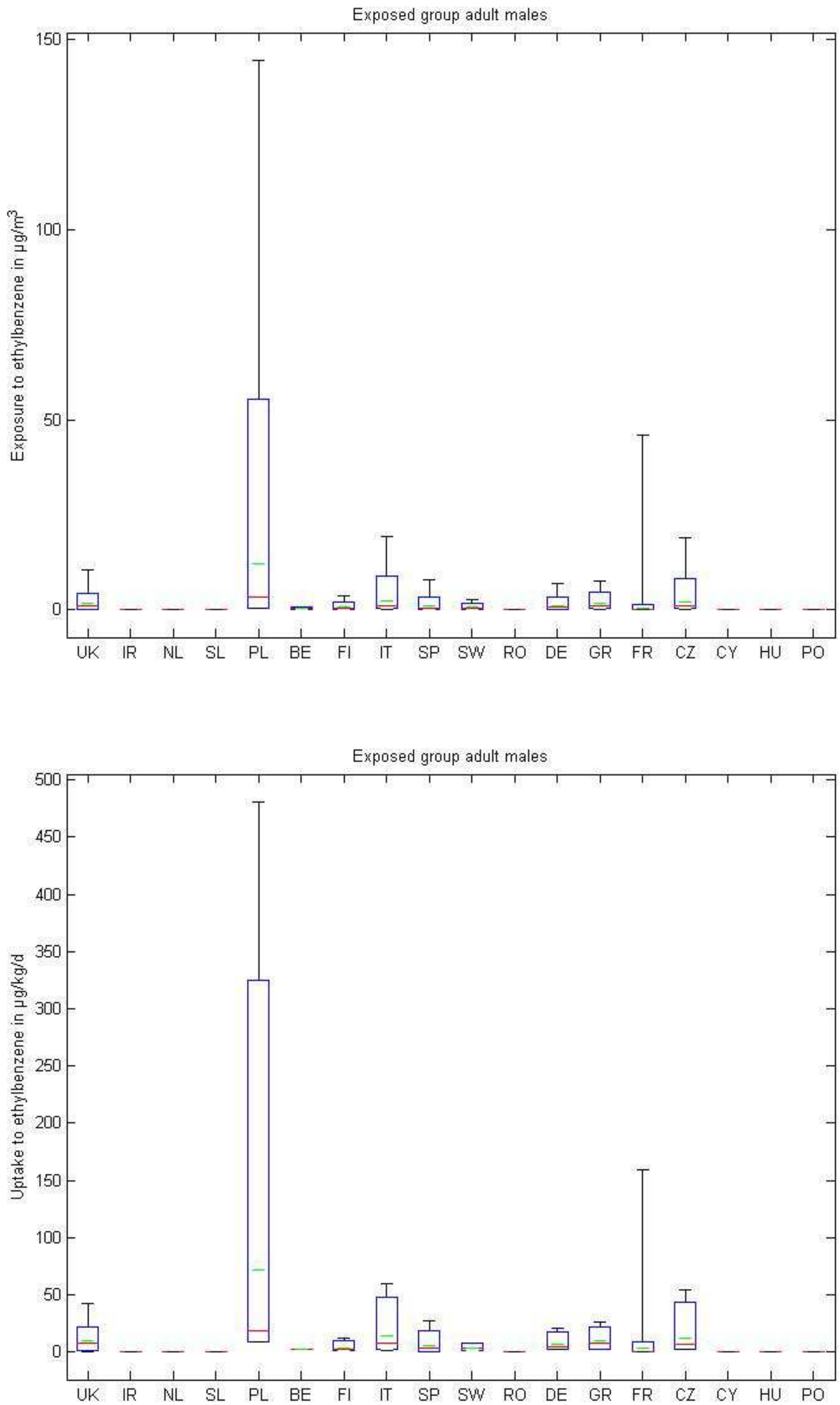


Figure 72. Whisker plots for ethylebenzene exposure and uptake, for adult males

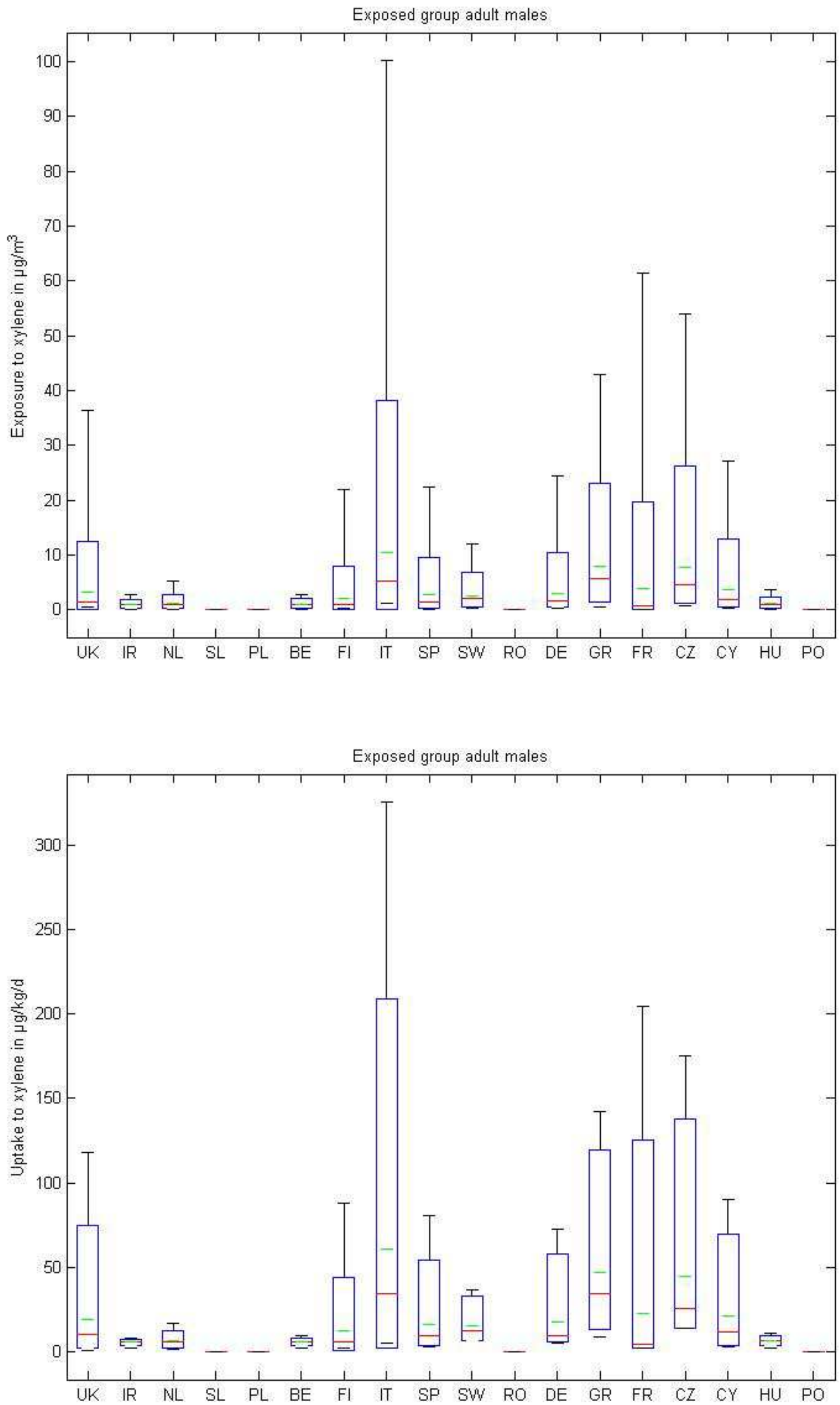


Figure 73. Whisker plots for xylene exposure and uptake, for adult males

Appendix 8 – Exposure, uptake and internal dose tables for BTEX

Table 28. Exposure to Benzene for all groups in µg/m³

Infants	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	0.1	1.3	2.6	2.1	0.6	1.1	0.3	0.0	0.0	0.2	2.7	1.0	0.5	0.1	1.5	2.5	6.0	2.7
P50	3.9	3.3	9.4	3.8	16.7	7.8	3.4	2.4	2.7	4.3	10.4	5.7	7.7	4.2	9.9	2.5	6.0	2.7
P95	92.9	5.2	17.8	4.7	295.1	28.8	12.2	149.2	62.1	22.8	22.5	13.0	54.3	45.5	32.3	2.5	6.0	2.7
Min	0.1	0.4	2.0	1.0	0.6	0.8	0.1	0.0	0.0	0.2	2.1	0.6	0.5	0.1	1.2	2.5	6.0	2.7
Max	127.3	5.5	18.8	4.8	404.1	33.0	14.1	240.7	88.7	27.4	24.0	14.1	66.1	58.3	36.1	2.5	6.0	2.7
Mean	19.0	3.3	9.7	3.7	63.0	10.7	4.5	24.7	12.5	7.1	11.3	6.3	15.6	11.3	12.7	2.5	6.0	2.7
Children 3 to 14	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	0.1	1.3	2.6	2.1	0.6	1.1	0.3	0.0	0.0	0.2	2.7	1.0	0.5	0.1	1.5	2.5	5.7	2.6
P50	3.9	3.3	9.5	3.8	16.7	7.5	3.4	2.4	2.7	4.3	10.4	5.7	7.7	4.2	9.9	2.5	5.7	2.6
P95	91.8	5.2	17.8	4.7	295.1	29.1	12.3	144.8	62.1	22.8	22.5	13.0	53.7	45.5	32.3	2.5	5.7	2.6
Min	0.1	0.4	2.0	1.0	0.6	0.8	0.1	0.0	0.0	0.2	2.1	0.6	0.5	0.1	1.2	2.5	5.7	2.6
Max	127.5	5.5	18.8	4.8	404.1	33.0	14.1	241.4	88.7	27.4	24.0	14.1	66.1	58.3	36.1	2.5	5.7	2.6
Mean	19.0	3.3	9.8	3.7	63.0	10.6	4.5	25.0	12.5	7.1	11.3	6.2	15.5	11.0	12.7	2.5	5.7	2.6
Adult females	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	0.1	1.3	2.6	2.1	0.6	1.1	0.3	0.0	0.0	0.2	2.7	1.2	0.5	0.1	1.5	2.4	4.6	2.7
P50	3.9	3.3	9.4	3.8	16.7	7.8	3.4	2.4	2.7	4.3	10.4	5.7	7.7	4.2	9.6	2.4	4.6	2.7
P95	92.9	5.2	17.8	4.7	295.1	28.8	12.2	149.2	62.1	22.8	22.5	13.0	54.3	45.5	32.0	2.4	4.6	2.7
Min	0.1	0.4	2.0	1.0	0.6	0.8	0.1	0.0	0.0	0.2	2.1	0.6	0.5	0.1	1.2	2.4	4.6	2.7
Max	127.3	5.5	18.8	4.8	404.1	33.0	14.1	240.7	88.7	27.4	24.0	14.1	66.1	58.3	36.2	2.4	4.6	2.7
Mean	19.0	3.3	9.8	3.7	63.0	10.7	4.5	24.7	12.5	7.1	11.3	6.3	15.3	11.0	12.7	2.4	4.6	2.7
Adult males	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	0.1	1.3	2.6	2.1	0.6	1.1	0.3	0.0	0.0	0.2	2.7	1.2	0.5	0.1	1.5	2.5	4.8	2.8
P50	3.9	3.3	9.4	3.8	16.7	7.8	3.4	2.4	2.7	4.3	10.4	5.7	7.7	4.2	9.6	2.5	4.8	2.8
P95	92.9	5.2	17.8	4.7	295.1	28.8	12.2	149.2	62.1	22.8	22.5	13.0	54.3	45.5	32.0	2.5	4.8	2.8
Min	0.1	0.4	2.0	1.0	0.6	0.8	0.1	0.0	0.0	0.2	2.1	0.6	0.5	0.1	1.2	2.5	4.8	2.8
Max	127.3	5.5	18.8	4.8	404.1	33.0	14.1	240.7	88.7	27.4	24.0	14.1	66.1	58.3	36.2	2.5	4.8	2.8
Mean	19.0	3.3	9.8	3.7	63.0	10.7	4.5	24.7	12.5	7.1	11.3	6.3	15.3	11.0	12.7	2.5	4.8	2.8

Table 29. Exposure to Toluene for all groups in µg/m^3

Infants	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	0.2	1.0	0.1	0.0	0.7	0.8	0.2	0.4	1.3	1.6	0.0	0.3	0.3	0.2	0.4	0.3	0.0	0.0
P50	9.1	2.7	2.4	0.0	12.5	3.6	2.9	13.0	4.5	5.2	0.0	3.8	0.3	3.4	6.8	5.6	0.0	0.0
P95	107.2	5.4	21.5	0.0	130.4	19.3	52.6	155.2	44.3	22.7	0.0	112.6	233.1	102.5	187.6	111.0	0.0	0.0
Min	0.2	0.4	0.1	0.0	0.7	0.4	0.2	0.4	0.2	0.7	0.0	0.3	0.3	0.2	0.4	0.3	0.0	0.0
Max	297.6	8.4	45.5	0.0	295.5	46.6	138.2	418.7	107.7	45.5	0.0	351.3	803.1	319.8	646.0	263.8	0.0	0.0
Mean	25.0	2.9	5.4	0.0	31.6	6.1	11.2	37.9	11.0	7.8	0.0	23.6	40.3	19.3	37.9	22.8	0.0	0.0
Children 3 to 14	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	0.2	0.6	0.4	0.0	2.1	0.8	0.2	0.5	0.7	0.6	0.0	0.4	0.4	0.2	0.5	0.4	0.0	0.0
P50	5.7	1.4	1.3	0.0	7.6	2.4	1.6	7.5	3.1	3.0	0.0	3.1	4.5	2.9	3.6	3.7	0.0	0.0
P95	50.2	2.8	10.4	0.0	63.4	9.8	26.9	73.6	20.9	15.4	0.0	55.0	117.9	50.2	96.0	65.7	0.0	0.0
Min	0.2	0.3	0.1	0.0	0.8	0.4	0.2	0.5	0.2	0.3	0.0	0.4	0.4	0.2	0.5	0.4	0.0	0.0
Max	137.3	3.7	23.5	0.0	137.0	18.1	68.6	176.5	47.3	30.5	0.0	133.6	405.6	131.6	308.5	163.7	0.0	0.0
Mean	12.9	1.5	2.8	0.0	16.3	3.4	6.0	18.7	5.6	4.9	0.0	12.0	20.9	10.0	20.1	13.8	0.0	0.0
Adult females	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	1.5	0.6	0.3	0.0	2.2	0.9	0.1	2.1	0.9	0.9	0.0	0.4	0.6	0.3	0.6	0.4	0.0	0.0
P50	9.1	1.5	1.6	0.0	7.2	2.7	2.3	8.7	3.5	3.0	0.0	3.4	6.2	2.2	4.6	4.1	0.0	0.0
P95	52.5	2.8	8.7	0.0	50.4	8.6	21.0	60.7	17.6	12.7	0.0	41.2	94.5	37.3	68.3	48.4	0.0	0.0
Min	0.2	0.3	0.2	0.0	1.2	0.4	0.1	0.7	0.5	0.4	0.0	0.4	0.6	0.3	0.6	0.4	0.0	0.0
Max	127.9	3.8	18.4	0.0	100.8	15.8	53.6	133.9	37.5	24.0	0.0	100.0	285.2	97.7	199.7	123.5	0.0	0.0
Mean	15.8	1.6	2.7	0.0	14.1	3.4	5.2	16.8	5.6	4.4	0.0	9.5	19.3	7.6	15.0	11.3	0.0	0.0
Adult males	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	1.4	0.5	0.7	0.0	2.1	0.8	0.1	1.9	1.2	0.9	0.0	0.4	0.6	0.3	0.6	0.5	0.0	0.0
P50	10.0	1.3	2.3	0.0	7.0	2.6	2.2	8.1	3.7	2.9	0.0	3.2	6.0	2.1	4.3	3.9	0.0	0.0
P95	53.3	2.6	9.2	0.0	47.6	8.2	19.6	57.8	16.8	11.9	0.0	39.1	90.1	35.1	65.9	46.2	0.0	0.0
Min	0.1	0.3	0.3	0.0	1.2	0.4	0.1	0.7	0.5	0.4	0.0	0.4	0.6	0.3	0.6	0.5	0.0	0.0
Max	123.7	3.4	18.5	0.0	97.9	15.2	51.3	124.8	35.9	22.5	0.0	94.7	271.8	91.9	187.1	114.7	0.0	0.0
Mean	15.9	1.4	3.2	0.0	13.6	3.3	5.0	16.0	5.4	4.2	0.0	9.2	18.7	7.2	14.4	10.9	0.0	0.0

Table 30. Exposure to ethylbenzene for all groups in µg/m^3

Infants	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	0.2	0.0	0.0	0.0	0.4	0.2	0.2	0.1	0.0	0.3	0.0	0.3	0.4	0.0	0.1	0.0	0.0	0.0
P50	1.5	0.0	0.0	0.0	5.9	0.6	1.0	2.1	0.9	0.9	0.0	1.3	2.4	0.0	2.3	0.0	0.0	0.0
P95	6.2	0.0	0.0	0.0	154.7	1.2	5.5	25.0	10.0	3.2	0.0	9.3	11.9	4.0	24.2	0.0	0.0	0.0
Min	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.1	0.0	0.1	0.0	0.1	0.2	0.0	0.1	0.0	0.0	0.0
Max	15.0	0.0	0.0	0.0	551.7	1.9	11.9	69.2	27.8	6.0	0.0	25.1	22.7	131.2	73.2	0.0	0.0	0.0
Mean	2.1	0.0	0.0	0.0	31.8	0.7	1.6	6.1	2.3	1.2	0.0	2.6	3.7	1.4	5.7	0.0	0.0	0.0
Children 3 to 14	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	0.1	0.0	0.0	0.0	0.4	0.2	0.1	0.1	0.1	0.2	0.0	0.2	0.3	0.0	0.1	0.0	0.0	0.0
P50	0.9	0.0	0.0	0.0	3.1	0.5	0.6	1.3	0.6	0.7	0.0	0.8	1.4	0.0	1.5	0.0	0.0	0.0
P95	3.7	0.0	0.0	0.0	75.6	1.0	2.9	11.7	4.7	2.3	0.0	4.5	6.0	1.9	12.0	0.0	0.0	0.0
Min	0.0	0.0	0.0	0.0	0.4	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0
Max	8.3	0.0	0.0	0.0	268.7	1.5	5.1	31.4	11.1	4.1	0.0	9.0	12.5	63.6	34.1	0.0	0.0	0.0
Mean	1.2	0.0	0.0	0.0	16.1	0.6	0.9	2.9	1.2	0.9	0.0	1.3	2.0	0.8	3.1	0.0	0.0	0.0
Adult females	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	0.2	0.0	0.0	0.0	0.5	0.2	0.1	0.3	0.1	0.1	0.0	0.2	0.3	0.0	0.3	0.0	0.0	0.0
P50	1.2	0.0	0.0	0.0	3.9	0.5	0.5	1.2	0.4	0.5	0.0	0.8	1.2	0.0	1.1	0.0	0.0	0.0
P95	4.3	0.0	0.0	0.0	57.5	0.9	2.2	9.3	3.6	1.8	0.0	3.5	4.7	1.5	8.5	0.0	0.0	0.0
Min	0.0	0.0	0.0	0.0	0.5	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0
Max	9.9	0.0	0.0	0.0	168.0	0.9	3.9	20.9	8.1	2.9	0.0	7.4	8.1	48.5	20.5	0.0	0.0	0.0
Mean	1.6	0.0	0.0	0.0	12.5	0.5	0.7	2.5	0.9	0.7	0.0	1.1	1.7	0.5	2.2	0.0	0.0	0.0
Adult males	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	0.2	0.0	0.0	0.0	0.5	0.2	0.1	0.3	0.1	0.1	0.0	0.2	0.3	0.0	0.3	0.0	0.0	0.0
P50	1.2	0.0	0.0	0.0	3.8	0.5	0.5	1.1	0.5	0.5	0.0	0.7	1.2	0.0	1.1	0.0	0.0	0.0
P95	4.4	0.0	0.0	0.0	55.3	0.8	2.0	8.7	3.4	1.7	0.0	3.4	4.5	1.4	8.1	0.0	0.0	0.0
Min	0.0	0.0	0.0	0.0	0.5	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0
Max	10.5	0.0	0.0	0.0	166.6	0.9	3.7	19.3	7.8	2.7	0.0	7.0	7.5	45.8	19.1	0.0	0.0	0.0
Mean	1.6	0.0	0.0	0.0	12.0	0.5	0.7	2.4	0.9	0.6	0.0	1.1	1.6	0.5	2.2	0.0	0.0	0.0

Table 31. Exposure to ethylbenzene for all groups in μg/m^3

Infants	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	0.1	0.6	0.2	0.0	0.0	0.6	0.1	0.3	0.1	0.0	0.0	0.3	1.2	0.1	0.4	0.2	0.6	0.0
P50	2.1	1.7	1.4	0.0	0.0	1.8	2.0	10.4	1.8	0.0	0.0	2.9	3.9	0.1	7.4	2.8	1.8	0.0
P95	35.0	3.9	5.6	0.0	0.0	4.5	20.2	104.5	25.6	0.0	0.0	29.3	10.2	59.9	68.1	28.6	5.0	0.0
Min	0.1	0.2	0.1	0.0	0.0	0.2	0.1	0.3	0.1	0.0	0.0	0.3	0.6	0.1	0.4	0.2	0.2	0.0
Max	99.9	6.9	12.0	0.0	0.0	9.2	47.9	336.7	88.2	0.0	0.0	88.2	16.4	230.1	233.9	66.2	8.8	0.0
Mean	6.8	1.9	1.9	0.0	0.0	2.1	4.9	25.2	5.9	0.0	0.0	7.2	4.6	10.4	16.8	7.0	2.2	0.0
Children 3 to 14	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	0.1	0.3	0.2	0.0	0.0	0.4	0.1	0.4	0.1	0.6	0.0	0.6	0.8	0.1	0.5	0.2	0.4	0.0
P50	1.1	0.9	0.8	0.0	0.0	1.1	1.3	4.7	1.5	2.1	0.0	2.2	2.4	1.0	4.8	1.8	1.1	0.0
P95	15.7	2.0	2.9	0.0	0.0	2.5	11.7	50.6	12.0	8.5	0.0	14.6	5.8	28.3	35.0	17.0	2.8	0.0
Min	0.1	0.1	0.1	0.0	0.0	0.2	0.1	0.4	0.1	0.3	0.0	0.3	0.4	0.1	0.5	0.2	0.2	0.0
Max	48.9	2.8	5.2	0.0	0.0	4.4	31.5	107.2	35.6	16.8	0.0	30.8	8.8	91.0	108.2	52.6	4.8	0.0
Mean	3.5	1.0	1.1	0.0	0.0	1.3	2.9	12.6	3.1	3.0	0.0	4.0	2.7	5.4	9.4	4.5	1.3	0.0
Adult females	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	0.1	0.4	0.2	0.0	0.0	0.4	0.1	0.2	0.4	0.6	0.0	0.5	1.4	0.1	1.3	0.5	0.4	0.0
P50	1.6	0.9	0.9	0.0	0.0	1.0	1.0	5.3	1.6	2.1	0.0	1.8	5.5	0.8	4.6	1.9	1.1	0.0
P95	13.1	1.9	2.8	0.0	0.0	2.1	8.4	40.5	9.8	7.1	0.0	10.7	22.2	21.3	27.0	13.6	2.6	0.0
Min	0.1	0.2	0.1	0.0	0.0	0.2	0.1	0.2	0.2	0.4	0.0	0.3	0.6	0.1	0.7	0.2	0.2	0.0
Max	38.4	2.9	5.4	0.0	0.0	3.0	22.6	103.7	24.2	12.9	0.0	25.7	41.5	65.4	56.6	28.1	3.8	0.0
Mean	3.3	1.0	1.1	0.0	0.0	1.1	2.2	10.8	2.8	2.7	0.0	3.0	7.7	4.1	7.8	3.7	1.3	0.0
Adult males	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	0.1	0.3	0.3	0.0	0.0	0.3	0.1	0.1	0.4	0.6	0.0	0.5	1.4	0.1	1.3	0.5	0.4	0.0
P50	1.5	0.9	0.9	0.0	0.0	0.9	0.9	5.2	1.5	2.0	0.0	1.7	5.6	0.7	4.5	1.8	1.1	0.0
P95	12.4	1.9	2.7	0.0	0.0	2.0	7.9	38.2	9.5	6.8	0.0	10.4	23.0	19.7	26.3	12.9	2.4	0.0
Min	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.4	0.0	0.3	0.6	0.1	0.7	0.2	0.2	0.0
Max	36.4	2.7	5.3	0.0	0.0	2.9	21.9	100.3	22.4	12.1	0.0	24.4	42.9	61.4	54.0	27.2	3.6	0.0
Mean	3.2	1.0	1.2	0.0	0.0	1.0	2.1	10.3	2.7	2.6	0.0	3.0	7.9	3.8	7.7	3.6	1.2	0.0

Table 32. Uptake to Benzene for all groups in µg/kg/d

Infants	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	0.0	0.3	0.7	0.4	0.5	0.5	0.2	0.0	0.0	0.3	0.8	0.4	0.5	0.1	0.5	2.5	6.0	2.7
P50	3.7	1.0	2.5	1.2	5.4	2.5	1.0	0.0	1.3	1.1	2.9	1.7	2.3	1.6	3.0	2.5	6.0	2.7
P95	32.2	2.4	7.3	2.4	90.9	11.5	4.3	41.9	20.1	5.6	9.1	5.6	17.8	15.4	12.8	2.5	6.0	2.7
Min	0.0	0.1	0.3	0.2	0.5	0.2	0.1	0.0	0.0	0.2	0.3	0.1	0.2	0.1	0.2	2.5	6.0	2.7
Max	91.9	4.5	13.2	3.8	244.8	29.3	11.3	182.2	62.6	11.2	16.6	11.6	35.5	36.6	28.1	2.5	6.0	2.7
Mean	8.2	1.1	3.1	1.3	19.8	3.7	1.4	7.2	4.2	1.8	3.7	2.2	4.8	3.7	4.3	2.5	6.0	2.7

Children 3 to 14	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	0.1	0.2	0.5	0.3	0.9	0.5	0.1	0.1	0.4	0.2	0.6	0.3	0.4	0.3	0.5	2.5	5.7	2.6
P50	2.5	0.6	1.4	0.8	2.3	1.5	0.5	0.8	1.2	0.8	1.8	1.0	1.7	1.9	1.9	2.5	5.7	2.6
P95	18.4	1.4	2.4	1.5	4.3	5.6	2.2	18.6	9.6	3.9	4.9	2.9	9.3	8.9	7.0	2.5	5.7	2.6
Min	0.1	0.1	0.4	0.2	0.7	0.2	0.0	0.1	0.1	0.1	0.3	0.1	0.2	0.1	0.3	2.5	5.7	2.6
Max	48.3	2.0	3.1	2.5	6.0	12.1	4.0	74.2	26.4	7.6	9.9	4.4	21.9	22.2	14.3	2.5	5.7	2.6
Mean	5.0	0.7	1.4	0.8	2.4	2.0	0.8	3.5	2.4	1.2	2.1	1.2	2.9	2.8	2.6	2.5	5.7	2.6

Adult females	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	0.5	0.2	0.5	0.3	1.6	0.3	0.1	0.0	0.3	0.1	0.6	0.3	0.6	0.2	0.5	2.4	4.6	2.7
P50	4.3	0.5	1.3	0.7	4.7	1.2	0.5	0.6	1.1	0.7	1.8	0.9	2.3	0.7	1.6	2.4	4.6	2.7
P95	19.5	1.1	3.4	1.3	34.3	4.4	1.8	15.7	7.6	3.1	4.4	2.3	8.4	5.5	5.2	2.4	4.6	2.7
Min	0.1	0.1	0.2	0.2	0.8	0.2	0.1	0.0	0.1	0.1	0.3	0.1	0.2	0.1	0.3	2.4	4.6	2.7
Max	47.6	1.6	5.1	1.9	78.6	7.1	3.4	52.4	18.3	5.8	7.1	3.4	17.7	12.0	9.2	2.4	4.6	2.7
Mean	6.3	0.5	1.5	0.7	9.1	1.6	0.7	3.0	2.0	1.0	2.0	1.0	3.1	1.5	2.0	2.4	4.6	2.7

Adult males	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	0.6	0.2	0.5	0.3	1.5	0.3	0.1	0.0	0.3	0.1	0.6	0.3	0.6	0.2	0.5	2.5	4.8	2.8
P50	4.6	0.5	1.3	0.7	4.6	1.2	0.5	0.5	1.0	0.6	1.6	0.9	2.4	0.7	1.6	2.5	4.8	2.8
P95	20.6	1.0	3.3	1.3	32.9	4.2	1.7	15.0	7.2	3.0	2.8	2.2	8.4	5.2	5.0	2.5	4.8	2.8
Min	0.0	0.1	0.2	0.2	0.8	0.2	0.1	0.0	0.1	0.1	0.5	0.1	0.2	0.1	0.3	2.5	4.8	2.8
Max	50.7	1.5	4.9	1.7	77.2	6.8	3.1	48.3	17.0	5.4	3.5	3.3	16.8	11.2	8.7	2.5	4.8	2.8
Mean	6.6	0.5	1.5	0.7	8.7	1.6	0.6	2.9	1.9	1.0	1.6	1.0	3.1	1.4	2.0	2.5	4.8	2.8

Table 33. Uptake to Toluene for all group in µg/kg/d

Infants	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	1.6	5.9	1.4	0.0	7.4	3.9	1.7	4.8	3.7	8.9	0.0	3.0	3.4	2.1	4.5	3.5	0.0	0.0
P50	30.2	8.9	8.3	0.0	44.8	12.3	10.8	50.4	13.7	17.7	0.0	16.9	3.4	6.8	21.3	20.1	0.0	0.0
P95	321.7	10.3	62.8	0.0	372.4	51.1	164.6	449.4	125.1	61.6	0.0	338.3	836.2	317.7	585.4	397.8	0.0	0.0
Min	1.6	4.4	1.4	0.0	7.4	3.9	1.7	4.8	2.1	8.3	0.0	3.0	3.4	2.1	4.5	3.5	0.0	0.0
Max	479.3	10.4	78.1	0.0	475.4	60.0	227.9	574.7	168.3	71.0	0.0	468.7	1414.9	480.3	846.4	558.9	0.0	0.0
Mean	76.5	8.6	17.5	0.0	98.8	18.3	36.0	118.5	32.9	24.6	0.0	71.3	133.8	59.1	116.7	84.5	0.0	0.0
Children 3 to 14	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	3.4	5.4	2.2	0.0	11.3	6.2	3.1	7.5	4.6	5.8	0.0	5.4	6.5	3.4	8.3	6.3	0.0	0.0
P50	28.3	7.5	7.0	0.0	37.3	12.1	9.4	43.1	14.2	15.2	0.0	15.1	6.5	10.1	20.0	17.9	0.0	0.0
P95	223.1	8.4	44.3	0.0	264.9	39.0	116.4	316.3	91.2	62.4	0.0	235.2	575.6	223.0	411.9	280.6	0.0	0.0
Min	3.4	4.3	2.2	0.0	11.3	6.2	3.1	7.5	3.4	5.1	0.0	5.4	6.5	3.4	8.3	6.3	0.0	0.0
Max	418.0	8.5	55.5	0.0	336.5	45.2	160.4	403.4	123.6	72.5	0.0	329.1	987.7	341.2	593.3	392.6	0.0	0.0
Mean	60.6	7.3	13.3	0.0	74.8	16.2	27.1	88.2	26.6	22.7	0.0	53.9	98.9	45.1	86.3	62.5	0.0	0.0
Adult females	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	7.8	6.9	3.3	0.0	22.0	7.9	2.4	12.8	11.3	8.9	0.0	6.3	10.0	5.2	10.0	7.6	0.0	0.0
P50	61.1	9.0	10.0	0.0	46.0	16.7	13.2	54.8	19.1	17.7	0.0	22.1	38.8	11.4	26.4	26.3	0.0	0.0
P95	264.4	10.5	44.4	0.0	255.5	41.0	114.1	310.7	90.9	61.6	0.0	223.6	557.4	207.3	381.2	262.6	0.0	0.0
Min	3.0	5.2	2.7	0.0	22.0	7.0	2.4	12.8	9.0	8.3	0.0	6.3	10.0	5.2	10.0	7.6	0.0	0.0
Max	487.1	11.1	58.3	0.0	321.4	53.0	182.5	432.4	121.2	71.0	0.0	321.3	970.3	316.2	555.9	382.6	0.0	0.0
Mean	90.2	8.9	15.1	0.0	80.5	19.6	29.5	94.2	31.1	24.6	0.0	52.9	110.3	42.7	83.0	63.4	0.0	0.0
Adult males	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	7.4	6.6	7.0	0.0	22.0	7.9	2.6	12.6	11.6	9.3	0.0	6.9	10.7	5.4	10.8	8.2	0.0	0.0
P50	63.2	8.7	13.7	0.0	46.0	16.7	13.6	54.8	20.7	18.0	0.0	22.5	39.3	11.5	27.0	26.9	0.0	0.0
P95	271.4	10.3	48.2	0.0	255.5	41.0	114.1	308.1	90.9	61.4	0.0	223.1	555.6	205.6	378.5	262.1	0.0	0.0
Min	2.3	4.8	6.4	0.0	22.0	7.0	2.6	12.6	9.3	8.7	0.0	6.9	10.7	5.4	10.8	8.2	0.0	0.0
Max	510.2	10.9	62.2	0.0	321.4	53.0	185.4	434.8	122.6	70.7	0.0	320.2	966.7	313.4	551.5	381.6	0.0	0.0
Mean	94.9	8.6	18.9	0.0	80.5	19.6	30.0	94.0	32.0	24.8	0.0	53.3	111.8	42.6	83.3	64.0	0.0	0.0

Table 34. Uptake to Ethylbenzene for all group in µg/kg/d

Infants	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	0.7	0.0	0.0	0.0	3.8	2.0	0.7	0.7	0.2	1.2	0.0	0.9	1.9	0.3	1.1	0.0	0.0	0.0
P50	5.2	0.0	0.0	0.0	18.5	2.0	3.4	8.7	2.5	3.5	0.0	4.4	9.1	0.3	7.7	0.0	0.0	0.0
P95	15.3	0.0	0.0	0.0	497.8	2.0	15.0	71.5	28.6	7.7	0.0	24.6	31.8	12.6	65.8	0.0	0.0	0.0
Min	0.2	0.0	0.0	0.0	3.8	2.0	0.5	0.7	0.2	0.9	0.0	0.9	1.6	0.3	1.1	0.0	0.0	0.0
Max	25.3	0.0	0.0	0.0	741.1	2.0	17.8	90.4	38.5	8.4	0.0	30.1	35.9	246.5	83.0	0.0	0.0	0.0
Mean	6.4	0.0	0.0	0.0	101.0	2.0	5.2	19.2	6.9	3.8	0.0	7.6	12.1	4.4	17.4	0.0	0.0	0.0
Children 3 to 14	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	0.8	0.0	0.0	0.0	6.9	2.7	0.9	1.1	0.6	1.1	0.0	1.4	2.2	0.5	1.8	0.0	0.0	0.0
P50	4.8	0.0	0.0	0.0	17.2	2.7	2.9	6.1	2.8	3.6	0.0	3.8	6.9	0.5	6.3	0.0	0.0	0.0
P95	14.7	0.0	0.0	0.0	350.2	2.7	10.9	50.9	20.3	8.1	0.0	18.0	22.9	9.1	46.8	0.0	0.0	0.0
Min	0.3	0.0	0.0	0.0	6.9	2.7	0.8	1.1	0.3	0.8	0.0	1.4	1.9	0.5	1.8	0.0	0.0	0.0
Max	24.9	0.0	0.0	0.0	519.2	2.7	12.7	63.4	28.5	8.8	0.0	21.7	25.8	172.8	58.7	0.0	0.0	0.0
Mean	5.8	0.0	0.0	0.0	74.4	2.7	4.1	13.8	5.4	3.9	0.0	6.0	9.3	3.9	13.1	0.0	0.0	0.0
Adult females	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	1.6	0.0	0.0	0.0	9.4	2.8	1.0	2.2	0.7	1.2	0.0	2.1	2.8	0.6	2.1	0.0	0.0	0.0
P50	8.0	0.0	0.0	0.0	18.9	2.8	2.9	7.5	2.8	3.5	0.0	4.4	7.8	0.6	6.3	0.0	0.0	0.0
P95	19.7	0.0	0.0	0.0	325.4	2.8	10.4	48.0	19.3	7.7	0.0	17.6	21.9	8.6	43.9	0.0	0.0	0.0
Min	0.4	0.0	0.0	0.0	9.4	2.8	0.9	1.6	0.4	0.9	0.0	2.1	1.8	0.6	2.1	0.0	0.0	0.0
Max	38.2	0.0	0.0	0.0	481.0	2.8	12.2	60.3	26.6	8.4	0.0	21.0	25.8	160.5	55.0	0.0	0.0	0.0
Mean	8.9	0.0	0.0	0.0	71.6	2.8	4.0	14.1	5.3	3.8	0.0	6.5	9.6	3.2	12.6	0.0	0.0	0.0
Adult males	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	1.6	0.0	0.0	0.0	9.4	2.8	1.0	2.1	0.7	1.2	0.0	2.3	3.0	0.7	2.3	0.0	0.0	0.0
P50	8.4	0.0	0.0	0.0	18.9	2.8	2.9	7.4	3.0	3.5	0.0	4.5	8.0	0.7	6.5	0.0	0.0	0.0
P95	21.8	0.0	0.0	0.0	325.4	2.8	10.3	47.5	19.2	7.6	0.0	17.6	22.1	8.6	43.7	0.0	0.0	0.0
Min	0.4	0.0	0.0	0.0	9.4	2.8	0.9	1.5	0.4	0.9	0.0	2.3	2.0	0.7	2.3	0.0	0.0	0.0
Max	42.4	0.0	0.0	0.0	481.0	2.8	12.1	59.7	26.9	8.3	0.0	21.0	25.9	159.0	54.7	0.0	0.0	0.0
Mean	9.6	0.0	0.0	0.0	71.6	2.8	4.0	13.9	5.4	3.8	0.0	6.6	9.8	3.3	12.7	0.0	0.0	0.0

Table 35. Uptake to Xylene for all groups in µg/kg/d

Infants	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	0.7	2.9	1.2	0.0	0.0	2.9	0.9	2.6	0.6	0.0	0.0	3.1	6.4	1.1	4.1	1.9	2.6	0.0
P50	5.6	6.0	5.2	0.0	0.0	6.6	6.4	34.0	7.1	0.0	0.0	9.3	15.0	4.2	21.7	10.9	7.0	0.0
P95	107.9	7.8	14.6	0.0	0.0	9.4	61.6	308.6	77.1	0.0	0.0	81.7	24.3	187.6	197.7	101.3	11.4	0.0
Min	0.7	1.9	0.9	0.0	0.0	2.0	0.9	2.6	0.6	0.0	0.0	3.1	5.6	1.1	4.1	1.9	2.0	0.0
Max	165.6	8.0	16.3	0.0	0.0	9.7	79.8	394.9	109.8	0.0	0.0	106.5	25.5	317.3	255.5	131.0	11.9	0.0
Mean	21.0	5.8	6.3	0.0	0.0	6.4	15.8	79.6	17.8	0.0	0.0	21.6	15.2	31.8	51.2	26.2	7.0	0.0
Children 3 to 14	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	1.5	2.8	1.5	0.0	0.0	3.4	1.1	5.9	2.2	4.2	0.0	5.0	6.6	1.6	7.4	3.4	2.8	0.0
P50	6.4	4.9	4.3	0.0	0.0	6.0	6.7	27.8	7.8	10.5	0.0	9.3	12.5	6.0	19.7	9.7	5.8	0.0
P95	74.6	6.2	10.8	0.0	0.0	7.9	46.7	218.8	55.6	32.7	0.0	59.6	19.0	136.6	141.9	71.6	9.0	0.0
Min	1.5	2.1	1.3	0.0	0.0	2.8	1.1	5.9	1.4	3.9	0.0	5.0	6.0	1.6	7.4	3.4	2.4	0.0
Max	123.3	6.3	12.0	0.0	0.0	8.2	94.2	278.8	82.3	37.1	0.0	76.8	19.8	222.9	182.1	93.1	9.3	0.0
Mean	16.7	4.7	5.0	0.0	0.0	5.9	13.2	58.7	14.6	13.7	0.0	17.9	12.7	24.6	40.1	20.3	5.9	0.0
Adult females	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	2.7	3.8	2.1	0.0	0.0	3.6	1.2	2.6	3.6	6.5	0.0	5.1	13.7	2.2	13.0	3.9	3.9	0.0
P50	9.7	5.9	5.9	0.0	0.0	6.2	6.2	34.4	8.9	12.4	0.0	9.2	32.0	4.3	24.4	10.9	6.8	0.0
P95	75.5	7.5	12.0	0.0	0.0	8.2	43.2	211.3	53.9	32.9	0.0	57.4	108.9	126.8	138.1	69.7	9.9	0.0
Min	1.6	2.4	1.3	0.0	0.0	2.6	1.2	2.6	2.8	6.2	0.0	4.4	8.8	2.2	13.0	3.0	2.7	0.0
Max	117.1	8.1	16.1	0.0	0.0	9.3	85.1	321.2	79.0	37.0	0.0	72.3	130.9	206.5	175.4	90.7	11.2	0.0
Mean	18.7	5.8	6.3	0.0	0.0	6.1	12.8	60.9	15.5	15.3	0.0	17.2	44.1	22.9	43.5	20.8	6.9	0.0
Adult males	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	2.3	3.8	2.4	0.0	0.0	3.6	1.2	2.4	3.6	6.8	0.0	5.9	13.1	2.2	14.4	4.2	3.7	0.0
P50	10.5	6.0	6.4	0.0	0.0	6.2	6.4	34.8	9.8	12.6	0.0	9.9	34.4	4.3	25.6	12.0	6.7	0.0
P95	74.8	7.5	12.4	0.0	0.0	8.3	43.8	209.3	54.1	33.0	0.0	57.7	119.5	125.6	138.2	69.6	9.8	0.0
Min	1.1	2.4	1.7	0.0	0.0	2.6	1.2	2.4	2.8	6.5	0.0	5.2	9.1	2.2	14.4	3.3	2.4	0.0
Max	118.1	8.2	16.8	0.0	0.0	9.4	88.1	325.6	80.6	37.0	0.0	72.5	142.1	204.5	175.2	90.6	11.1	0.0
Mean	18.9	5.8	6.8	0.0	0.0	6.1	12.9	61.1	16.0	15.5	0.0	17.9	47.3	22.8	44.5	21.2	6.7	0.0

Table 36. Benzene venous concentration for all exposed groups in µg/L

Infants	UK	IR	NL	SL	PL	BE	FI	IT	SP	SW	RO	DE	GR	FR	CZ	CY	HU	PO
P5	1.4E-04	2.0E-03	4.4E-03	3.3E-03	1.7E-03	2.6E-03	5.7E-04	8.2E-05	1.9E-04	4.7E-03	4.5E-03	1.8E-03	2.4E-03	3.4E-04	3.2E-03	4.8E-03	1.1E-02	5.4E-03
P50	1.2E-02	5.3E-03	1.5E-02	6.5E-03	3.0E-02	1.3E-02	5.5E-03	8.2E-05	4.3E-03	1.0E-02	1.7E-02	9.4E-03	1.3E-02	7.3E-03	1.7E-02	8.3E-03	2.0E-02	9.4E-03
P95	1.6E-01	1.0E-02	3.4E-02	9.9E-03	5.0E-01	5.3E-02	2.2E-02	2.5E-01	1.1E-01	3.6E-02	4.2E-02	2.5E-02	9.6E-02	7.8E-02	5.9E-02	1.1E-02	2.5E-02	1.2E-02
Min	1.4E-04	4.8E-04	2.2E-03	1.5E-03	1.7E-03	1.0E-03	2.4E-04	8.2E-05	1.9E-04	3.1E-03	2.2E-03	8.5E-04	8.4E-04	3.4E-04	1.5E-03	3.8E-03	9.2E-03	4.2E-03
Max	3.0E-01	1.3E-02	4.6E-02	1.2E-02	9.4E-01	7.8E-02	3.3E-02	5.7E-01	2.0E-01	5.7E-02	6.0E-02	3.4E-02	1.6E-01	1.4E-01	8.6E-02	1.2E-02	2.8E-02	1.3E-02
Mean	3.5E-02	5.7E-03	1.7E-02	6.5E-03	1.1E-01	1.9E-02	7.8E-03	4.2E-02	2.2E-02	1.4E-02	2.0E-02	1.1E-02	2.7E-02	1.9E-02	2.2E-02	8.1E-03	1.9E-02	9.1E-03
Children 3 to 14	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	3.5E-04	2.3E-03	7.0E-03	3.7E-03	1.2E-02	2.0E-03	6.3E-04	3.1E-04	5.2E-04	1.1E-03	5.5E-03	2.1E-03	2.7E-03	4.9E-04	3.3E-03	4.9E-03	1.2E-02	5.6E-03
P50	9.1E-03	5.5E-03	1.2E-02	6.9E-03	2.0E-02	1.3E-02	5.5E-03	6.0E-03	4.5E-03	6.9E-03	1.7E-02	9.3E-03	1.4E-02	7.4E-03	1.7E-02	8.4E-03	2.0E-02	9.7E-03
P95	1.6E-01	1.0E-02	1.6E-02	1.0E-02	2.6E-02	5.3E-02	2.2E-02	2.4E-01	1.1E-01	4.0E-02	4.3E-02	2.4E-02	9.3E-02	7.7E-02	5.9E-02	1.1E-02	2.6E-02	1.2E-02
Min	3.5E-04	8.8E-04	5.5E-03	1.9E-03	9.1E-03	1.3E-03	3.0E-04	3.1E-04	5.2E-04	4.2E-04	2.6E-03	7.9E-04	1.2E-03	4.9E-04	1.6E-03	4.0E-03	9.3E-03	4.5E-03
Max	2.9E-01	1.3E-02	1.7E-02	1.3E-02	2.9E-02	7.9E-02	3.3E-02	5.7E-01	2.0E-01	6.5E-02	6.0E-02	3.4E-02	1.6E-01	1.4E-01	8.6E-02	1.2E-02	2.9E-02	1.4E-02
Mean	3.4E-02	5.9E-03	1.2E-02	7.0E-03	2.0E-02	1.8E-02	7.8E-03	4.2E-02	2.2E-02	1.2E-02	2.0E-02	1.1E-02	2.7E-02	1.9E-02	2.2E-02	8.2E-03	2.0E-02	9.4E-03
Adult females	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	7.9E-03	3.8E-03	1.2E-02	5.9E-03	3.4E-02	9.7E-03	4.1E-03	1.7E-03	5.3E-03	4.6E-03	1.6E-02	7.5E-03	1.3E-02	6.5E-03	1.2E-02	8.4E-03	1.8E-02	7.4E-03
P50	7.1E-02	7.0E-03	2.2E-02	1.0E-02	7.1E-02	2.0E-02	8.8E-03	6.0E-03	1.6E-02	1.0E-02	2.8E-02	1.3E-02	2.5E-02	1.3E-02	2.5E-02	1.4E-02	3.2E-02	1.3E-02
P95	3.5E-01	1.1E-02	3.9E-02	1.4E-02	4.1E-01	5.2E-02	2.2E-02	1.8E-01	8.9E-02	3.6E-02	5.0E-02	2.8E-02	8.7E-02	6.5E-02	5.9E-02	1.8E-02	4.3E-02	1.6E-02
Min	9.3E-04	2.1E-03	7.3E-03	4.0E-03	2.6E-02	6.3E-03	2.4E-03	1.7E-03	1.7E-03	3.0E-03	1.0E-02	4.5E-03	7.9E-03	4.3E-03	8.0E-03	6.7E-03	1.6E-02	5.7E-03
Max	7.0E-01	1.4E-02	5.0E-02	1.6E-02	7.7E-01	7.4E-02	3.1E-02	4.4E-01	1.8E-01	5.6E-02	6.6E-02	3.0E-01	1.4E-01	1.1E-01	8.2E-02	2.0E-02	2.9E-01	1.8E-02
Mean	1.1E-01	7.2E-03	2.3E-02	9.9E-03	1.3E-01	2.4E-02	1.0E-02	3.4E-02	2.7E-02	1.4E-02	3.0E-02	1.5E-02	3.4E-02	2.1E-02	2.9E-02	1.4E-02	3.2E-02	1.2E-02
Adult males	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	7.9E-03	3.8E-03	1.1E-02	5.9E-03	3.3E-02	9.7E-03	4.1E-03	1.3E-03	2.5E-02	4.6E-03	1.6E-02	7.2E-03	1.3E-02	6.4E-03	1.3E-02	8.4E-03	1.9E-02	7.4E-03
P50	7.0E-02	7.0E-03	2.2E-02	1.0E-02	7.1E-02	2.0E-02	8.7E-03	5.7E-03	2.5E-02	1.0E-02	2.7E-02	1.4E-02	2.6E-02	1.3E-02	2.5E-02	1.4E-02	3.3E-02	1.3E-02
P95	3.5E-01	1.1E-02	3.9E-02	1.4E-02	4.1E-01	5.2E-02	2.1E-02	1.8E-01	2.5E-02	3.6E-02	3.3E-02	2.7E-02	8.6E-02	6.5E-02	5.8E-02	1.8E-02	4.2E-02	1.6E-02
Min	9.8E-04	2.1E-03	7.3E-03	4.0E-03	2.6E-02	6.3E-03	2.4E-03	0	0	3.0E-03	1.2E-02	4.6E-03	7.9E-03	4.2E-03	8.1E-03	6.7E-03	1.6E-02	5.7E-03
Max	6.9E-01	1.4E-02	5.0E-02	1.6E-02	7.7E-01	7.3E-02	3.1E-02	4.3E-01	1.8E-01	5.6E-02	3.7E-02	3.4E-02	1.4E-01	1.1E-01	8.2E-02	2.0E-02	8.2E-02	1.8E-02
Mean	1.1E-01	7.2E-03	2.3E-02	9.9E-03	1.3E-01	2.4E-02	1.0E-02	3.4E-02	2.9E-02	1.4E-02	2.6E-02	1.5E-02	3.5E-02	2.1E-02	2.9E-02	1.4E-02	3.2E-02	1.2E-02

Table 37. Concentration of toxic metabolites in marrow barrow in µg/L

Infants	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	1.4E-03	1.6E-02	3.6E-02	2.1E-02	1.5E-02	3.8E-02	1.2E-02	7.8E-04	2.1E-03	2.8E-02	3.7E-02	2.3E-02	2.7E-02	3.7E-03	8.2E-03	2.0E-02	7.3E-02	3.6E-02
P50	1.6E-01	4.4E-02	9.8E-02	4.8E-02	2.4E-01	1.0E-01	4.3E-02	7.8E-04	5.3E-02	7.3E-02	1.2E-01	7.2E-02	8.8E-02	6.5E-02	1.2E-01	3.9E-02	1.5E-01	7.4E-02
P95	1.4E+00	1.1E-01	2.6E-01	1.0E-01	3.7E+00	4.8E-01	1.6E-01	1.8E+00	8.6E-01	2.7E-01	3.6E-01	2.7E-01	6.4E-01	6.8E-01	6.7E-01	6.2E-02	2.8E-01	1.4E-01
Min	1.4E-03	4.0E-03	1.0E-02	7.9E-03	1.5E-02	6.5E-03	1.7E-03	7.8E-04	2.1E-03	9.6E-03	1.1E-02	6.6E-03	6.9E-03	3.7E-03	8.2E-03	1.1E-02	2.7E-02	1.6E-02
Max	5.2E+00	4.1E-01	8.9E-01	2.3E-01	1.1E+01	3.2E+00	1.0E+00	1.6E+01	5.1E+00	9.1E-01	8.7E-01	1.6E+00	2.0E+00	3.1E+00	3.9E+00	1.3E-01	6.0E-01	3.0E-01
Mean	3.4E-01	5.1E-02	1.2E-01	5.4E-02	8.3E-01	1.7E-01	5.7E-02	3.1E-01	1.9E-01	1.0E-01	1.5E-01	1.0E-01	1.9E-01	1.7E-01	2.1E-01	4.0E-02	1.6E-01	7.8E-02
Children 3 to 14	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	2.9E-03	6.6E-03	1.6E-02	9.9E-03	2.6E-02	1.3E-02	3.9E-03	1.9E-03	1.1E-02	5.0E-03	1.6E-02	1.0E-02	2.0E-02	9.7E-03	1.7E-02	1.3E-02	2.7E-02	1.2E-02
P50	5.6E-02	1.4E-02	3.0E-02	2.0E-02	5.3E-02	3.4E-02	1.2E-02	2.4E-02	3.0E-02	1.7E-02	4.2E-02	2.5E-02	4.6E-02	5.0E-02	4.8E-02	2.5E-02	6.1E-02	2.6E-02
P95	3.9E-01	2.6E-02	5.0E-02	3.6E-02	9.7E-02	1.0E-01	4.1E-02	3.4E-01	1.7E-01	7.2E-02	9.5E-02	5.5E-02	1.7E-01	2.0E-01	1.7E-01	4.9E-02	1.2E-01	5.1E-02
Min	2.9E-03	3.1E-03	7.5E-03	4.1E-03	1.3E-02	5.1E-03	1.4E-03	1.9E-03	4.3E-03	2.5E-03	6.2E-03	3.4E-03	6.5E-03	3.9E-03	6.3E-03	5.6E-03	1.2E-02	5.4E-03
Max	1.1E+00	7.1E-02	9.7E-02	1.0E-01	2.3E-01	4.2E-01	8.5E-02	2.2E+00	6.4E-01	2.5E-01	3.3E-01	1.0E-01	6.7E-01	5.9E-01	1.1E+00	1.9E-01	5.1E-01	2.1E-01
Mean	1.1E-01	1.5E-02	3.1E-02	2.1E-02	5.7E-02	4.3E-02	1.7E-02	6.3E-02	4.9E-02	2.6E-02	4.7E-02	2.8E-02	6.2E-02	7.0E-02	7.1E-02	2.8E-02	6.5E-02	2.8E-02
Adult females	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	1.5E-02	4.8E-03	1.2E-02	7.5E-03	3.7E-02	8.3E-03	3.3E-03	1.3E-03	1.0E-02	4.7E-03	1.7E-02	7.4E-03	1.6E-02	4.3E-03	1.3E-02	9.8E-03	1.6E-02	1.1E-02
P50	9.4E-02	9.6E-03	2.6E-02	1.5E-02	9.0E-02	2.2E-02	9.2E-03	2.4E-02	2.4E-02	1.3E-02	3.6E-02	1.7E-02	5.9E-02	1.2E-02	3.2E-02	1.9E-02	3.3E-02	2.0E-02
P95	4.1E-01	1.8E-02	5.3E-02	2.5E-02	4.7E-01	6.1E-02	2.6E-02	2.5E-01	1.2E-01	4.8E-02	7.3E-02	3.7E-02	1.5E-01	8.4E-02	8.1E-02	3.1E-02	5.1E-02	3.0E-02
Min	1.4E-03	1.8E-03	4.0E-03	3.2E-03	1.6E-02	4.0E-03	1.1E-03	1.3E-03	4.9E-03	2.3E-03	6.5E-03	3.0E-03	5.8E-03	2.3E-03	5.0E-03	3.5E-03	7.1E-03	5.6E-03
Max	1.3E+00	3.9E-02	1.1E-01	5.0E-02	1.1E+00	1.1E-01	7.5E-02	1.1E+00	2.7E-01	1.2E-01	1.5E-01	7.6E-02	3.6E-01	2.0E-01	2.2E-01	4.8E-02	8.9E-01	4.4E-02
Mean	1.4E-01	1.0E-02	2.8E-02	1.5E-02	1.5E-01	2.7E-02	1.1E-02	5.4E-02	3.7E-02	1.9E-02	3.9E-02	1.9E-02	6.8E-02	2.4E-02	3.7E-02	1.9E-02	3.4E-02	2.0E-02
Adult males	**UK**	**IR**	**NL**	**SL**	**PL**	**BE**	**FI**	**IT**	**SP**	**SW**	**RO**	**DE**	**GR**	**FR**	**CZ**	**CY**	**HU**	**PO**
P5	1.2E-02	4.0E-03	1.1E-02	6.5E-03	3.4E-02	7.9E-03	3.1E-03	1.2E-03	1.1E-02	4.8E-03	1.5E-02	6.5E-03	1.6E-02	5.1E-03	1.3E-02	8.5E-03	1.5E-02	9.1E-03
P50	8.7E-02	8.3E-03	2.3E-02	1.3E-02	8.2E-02	1.9E-02	7.7E-03	1.7E-02	2.0E-02	1.2E-02	2.9E-02	1.5E-02	5.1E-02	1.1E-02	2.9E-02	1.7E-02	2.8E-02	1.7E-02
P95	4.0E-01	1.5E-02	4.5E-02	2.2E-02	4.1E-01	5.0E-02	2.0E-02	1.9E-01	3.1E-02	3.7E-02	4.8E-02	3.1E-02	1.4E-01	6.3E-02	6.5E-02	2.8E-02	4.8E-02	2.6E-02
Min	1.3E-03	1.7E-03	4.1E-03	2.9E-03	1.5E-02	4.1E-03	1.0E-03	1.2E-03	6.1E-03	2.2E-03	7.5E-03	3.0E-03	5.7E-03	2.2E-03	4.9E-03	3.0E-03	6.3E-03	5.1E-03
Max	1.1E+00	2.8E-02	9.0E-02	3.9E-02	9.8E-01	1.3E-01	5.2E-02	7.8E-01	4.1E-02	9.0E-02	8.6E-02	6.2E-02	5.1E-01	1.4E-01	1.6E-01	4.2E-02	1.1E-01	3.6E-02
Mean	1.3E-01	8.7E-03	2.5E-02	1.3E-02	1.3E-01	2.3E-02	9.1E-03	4.3E-02	2.0E-02	1.5E-02	3.0E-02	1.6E-02	6.1E-02	1.9E-02	3.2E-02	1.7E-02	2.9E-02	1.7E-02