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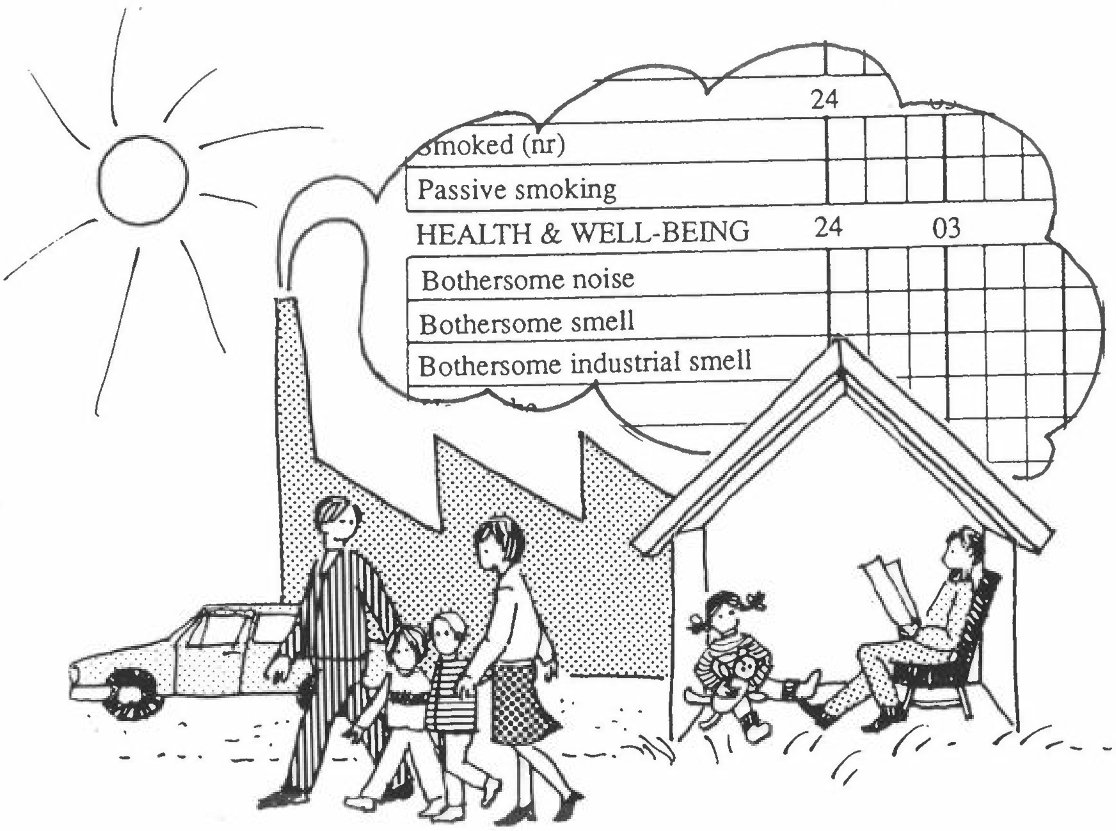
Air pollution and short-term health effects in an industrialized area in Norway

ESTIMATING INDIVIDUAL AIR POLLUTION EXPOSURE



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AIR POLLUTION AND SHORT-TERM HEALTH EFFECTS IN AN INDUSTRIALIZED AREA IN NORWAY

ESTIMATING INDIVIDUAL AIR POLLUTION EXPOSURE

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PREFACE

This report is part of a series of reports published to document the investigation "Air pollution and short-term health effects in an industrialized area in Norway". Most of the reports in this series are written in Norwegian, with English summaries. There exists a summary report in both English and Norwegian that summarizes the entire project (NILU/ NIPH, 1991a, b).

The investigation was financed by the Ministry of Environment, the Norwegian State Pollution Control Authority and the Royal Norwegian Council for Scientific and Industrial Research/ Norwegian Research Council for Science and the Humanities.

The study was a cooperative project between the Norwegian Institute for Air Research, the National Institute for Public Health and the Norwegian Computing Center.

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SAMMENDRAG

I 1988 tok Miljøverndepartementet og Statens forurensningstilsyn initiativ til en undersøkelse av korttids helseeffekter av luftforurensning i Grenland, et industrielt område i Norge. En kohort type epidemiologisk undersøkelse ble satt igang med egen rapportering av symptomer av redusert helse og luftforurensningseksponering av 400 mennesker på timebasis (over fire måneder).

Konsentrasjonsfordelinger i tid og rom av luftforurensning er nødvendig for å undersøke korttids helseeffekter av luftforurensning. Rapporten beskriver delene av modellen utarbeidet for å estimere eksponering til nitrogenmonoksid, nitrogendioksid, svoveldioksid, ozon, svevestøv (finfraksjon), nitrat, sulfat, pollen fra gress og bjerk, temperatur og relativ fuktighet.

Estimatene ble beregnet ved å slå sammen informasjon om tidsforbruk innhentet ved dagbok, timevise konsentrasjoner av luftforurensningkomponenter målt ved fem stasjoner og beregnet ved bruk av spredningsmodeller basert på utslipp.

Rapporten presenterer sammendrag av informasjon om tidsforbruk innhentet ved dagbok og befolkningsgruppenes eksponering til forurensningskonsentrasjoner i forskjellige miljøer.

Estimatorenes statistiske egenskaper er beskrevet og deres anvendelse i kohort helseundersøkelsen er vurdert.

SUMMARY

The Ministry of the Environment and the Norwegian State Pollution Control Authority initiated in 1988 an investigation of the short term health effects of air pollution in Grenland, an industrialized area of Norway. A cohort study design was chosen which followed the health status and air pollution exposure of 400 individuals hourly for four months.

In assessing the short-term health effects of air pollution it is necessary to refine and describe in space and time the measure of air pollution exposure. This report describes the elements that entered into the model used to estimate individual exposure to nitrogen monoxide, nitrogen dioxide, sulfur dioxide, ozone, suspended particles, nitrates, sulfates, grass and birch pollen, temperature and relative humidity.

The estimates were calculated combining time budget information from a daily diary, hourly concentrations of air pollution contaminants, both measured at five monitoring stations, and modelled using an air quality dispersion model based on information on pollution emissions.

Both results of the time budget information from the diary, and summaries of exposure to the different compounds by different population subgroups and under different environmental conditions are presented.

Statistical properties of the estimates are also discussed that allow judging the use of these estimates in the cohort health study investigation.

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1 INTRODUCTION

In order to establish guidelines for pollutant concentrations, it is necessary to know at what levels pollutants disturb human health. In 1979, an investigation was done in an industrialized area of Norway, the Grenland area, which indicated that air pollution was leading to adverse health effects, (Siem and Skogvold, 1981). Pollution seemed to especially influence symptoms involving the airways, such as coughing or wheezing. However, there were also more cases of headaches in areas with heavier air pollution. This earlier study was a cross-sectional epidemiological study. As is usual in such studies, it was impossible to rule out that effects that seemed due to air pollution, were not rather due to such confounding factors as age and socioeconomic status. If the effect was due to air pollution, it was impossible to identify which compound was responsible for the effect, and to quantify at which concentration the pollutant caused such effects.

The Grenland area lies in the county of Telemark in the south-eastern part of Norway and is one of the most industrialized areas in the country. There are several sources of air pollution in the Grenland area: petrochemical, chemical, paper, magnesium, cement industries, in addition to important contributions from long-range transport and traffic pollution. Around 100 000 people live in the area, mostly in the towns of Skien and Porsgrunn. Pollution control of emissions and air quality are done continuously by the Norwegian State Pollution Control Authority's local control section. Two of the measuring stations used in this study are part of a nation-wide control program for air quality in cities and towns.

Therefore, a follow-up investigation was designed to attempt to identify and quantify which compound or compounds, if any, were responsible for adverse health effects in the area. A cohort study, where a group of individuals is followed over time, can address this issue. Since each individual is his/her own control, the problem of confounding factors is reduced. The study was designed to follow two groups of individuals, one suffering from pre-existing lung disease, and the other based on a randomly selected group representative of the population living in the Grenland area. Since pollutants originate from several sources in the area, the individual components vary independently of each other. The possibility existed to identify individual pollutants and quantify the concentrations necessary to provoke a health effect.

The aim of the investigation is therefore to establish if air pollution in the Grenland area affects the short-term health and well-being of the individuals living in the area. It is desirable to examine the effects of each compound individually and in combination, and also to examine possible potentiating synergistic or antagonistic effects of meteorological factors in combination with air pollution.

The cohort study was designed so that the two populations were followed hour by hour for two months in the winter and two months in the summer. Each participant described through a special diary where he/she was and whether or not the individual was bothered by any of a number of symptoms. In addition to self-reporting of symptoms, each individual measured peak expiratory flow and noted when and what medication was used.

It is evident that such an investigation demands a refined measure of air pollution exposure. A measurement and modelling program is necessary, which will quantify exposure using concentrations of pollutants in different micro-environments that the participants are in at the time, or before health is affected.

In this study, each participant's exposure to air pollution is estimated. In order to do this, a model is used which estimates outdoor air pollutant concentrations on a 1 km grid for the entire region for each day and hour of the investigation. The model calculates levels of air pollutants based on information about the emission of contaminants from all primary sources in the area and on prevailing meteorological conditions. Measurements of air pollutant concentrations at the fixed stations in the area are used to correct the model calculations. Results of the calculations by the model, combined with information of indoor air quality and information as to where each individual has been for each hour and day of the study (from a diary) is used to calculate each individual's hourly exposure. This exposure information will then be related to health status and well-being measured subjectively by a diary filled out by each individual and with measurements of each individual's peak expiratory flow, measured four times a day.

2 LITERATURE SURVEY

There is little disagreement that a major flaw with most previous studies of the health effects of air pollution has been insufficient information on exposure to the various pollutants of interest (WHO, 1982; Ott, 1985).

The most frequently used method has been fixed site air quality monitoring stations, where the number and location of sites vary considerably between studies. However, it is no longer considered sufficient to restrict information to fixed site monitoring. There is also now, a known need for information on indoor air quality so that total inhalation exposure can be assessed.

As health effect studies have been refined in the later years, the advantage of cohort studies has been discussed. In such studies one follows a group of individuals over time with continuous follow-up of symptoms, disease, medication use etc. In order to investigate the impact of air pollution on health in such cohort studies, it has therefore been important to develop continuous measurements of exposure to the various components. There are two principal methods of measuring exposure on a continuous (at least hourly) basis. The best is continuous monitoring with portable equipment for each individual. This method is expensive, difficult to perform with many individuals and/or for long periods of time, and it is uncertain as to how much individuals alter their daily routine because they have to carry an instrument on them.

The other method of measuring exposure continuously, is the diary method of exposure estimating. This method consists of combining time budget information from a diary as to each individual's location in different micro-environments (such as at work, at home, in the garden, in a car, etc.) with measurements in these different micro-environments. This method was first suggested by Fugas in 1976, and refined by Duan (1982) and Moschandreas (1981).

Since the concept and analysis methods of using cohort studies in the investigation of the health effects of air pollution is relatively new (from Korn and Whittemore, 1979) and costly, there have not been very many such studies performed. However, of those that have been done, some have used fixed site to estimate air pollution exposure (Perry et al., 1982; Freziéres et al., 1982).

Silverman et al. (1982 a,b) were able to find a significant effect of NO_2 on the health effects of a group of asthmatics if they used portable measurements, but were unable to see this when restricted to fixed-site measurements.

A study done in Houston (Holguin et al., 1985; Stock et al., 1985a,b) used the diary method, combined with a three tiered sampling system, a fixed outdoor measuring site, an indoor measuring program and portable monitoring of selected individuals. This study was used as a guide in the development of a method of estimating exposure for the current investigation of the short-term health effects of air pollution in an industrialized area (Grenland) in Norway.

3 GENERAL DESCRIPTION OF THE INVESTIGATION

The intention of the study was to relate health and well-being to exposure to air pollutants. This necessitates designing a study that describes these two facets of the problem in detail. The time scale should be sufficiently small so that exposure to air pollution can be accurately described. The participants filled out a diary every day that covered both their movements and subjective feelings of ill health, hour by hour. The specification of spatial and time gradients in air pollution concentrations is of fundamental importance to discriminate exposure on an individual basis. By hourly resolution in time it was found that exposure to each air contaminant could be estimated based on relatively accurate information on concentrations of pollution in each of the micro-environments that individuals were exposed to.

Two groups of subjects participated in this study. The first was a group having pre-existing lung disease (85 individuals) and the other volunteers from a randomly selected subsample of the population living in the region and comprised 312 individuals out of an original sample of 800, ranging in age from 18 to 75 years.

The investigation was done in two periods: a winter period (January 1 to March 11) and a summer period (April 18 to June 24, 1988). Most air contaminants have higher concentrations in the winter than in the summer with the exception of ozone which is higher in the summer. However, since people are more outdoors or indoors with open windows in the summer, it is not evident that exposure to pollution is higher in the winter. In addition, it seemed valuable to follow up those with lung disease or hay fever while they were being exposed to pollen in the summer to see if pollution had a potentiating effect.

Estimating exposure to air pollution for each individual required knowing the concentrations of each pollutant outdoors in different geographical areas. A geographic resolution of km^2 was found acceptable when special data were developed for polluted subregions such as streets with high traffic and maximum zones of influence from local point sources. Estimated indoor values must then be adjusted to reflect values outdoors.

In the diary, all participants specified for each hour of each day, where they were geographically, whether they were indoors or outdoors, and if they were indoors, whether or not the window was open. Individuals were also to indicate whether they were travelling or shopping and how much traffic they were encountering. Each participant noted whether or not he/she was sleeping, doing normal daily activities or was exercising. Finally each person was to note how many cigarettes he/she smoked for each hour or whether or not they were exposed to other peoples' smoke.

In order to investigate if pollution has a short-term or acute effect on the health and well-being of both healthy participants and those with pre-existing lung disease, each individual was asked to fill out if he/she had any of a set of health symptoms such as wheezing, sneezing, headache etc. on an hourly basis. (The diary is shown in Figure 3.1).

NILU SIFF

DATE [ ] YOUR I.D. NR. [ ]

WHERE ARE YOU?	24 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Where are you (use code)	
Are you indoors	
Is the window open where you are	
Are you outdoors	

WHAT ARE YOU DOING?	24 03 06 09 12 15 18 21 24
Sleeping	
Daily activities	
Hard work/training	

HAVE YOU TRAVELLED (minutes)	03 06 09 12 15 18 21 24
Much traffic	
Average traffic	
Little traffic	

HAVE YOU BEEN SHOPPING (minutes)	06 09 12 15 18 21 24
In Skien	
In Porsgrunn	
Other places	

SMOKING	24 03 06 09 12 15 18 21 24
Smoked (nr)	
Passive smoking	

HEALTH & WELL-BEING	24 03 06 09 12 15 18 21 24
Bothersome noise	
Bothersome smell	
Bothersome industrial smell	
Headache	
Dizziness	
Nausea	
Running/burning eyes	
Sneezing/running nose	
Feeling feverish	
Throat irritation	
Coughing	
Wheezing/tightness in chest	
Difficult breathing	
Muscle pains (neck/back)	
Stomach pains	
Nervous	
Tired	

Figure 3.1: Diary used in study.

4 OUTDOOR AIR QUALITY, INDOOR AIR QUALITY AND DISPERSION AIR POLLUTION MODELLING

Spatial outdoor concentration distribution in this study was calculated using estimates of hourly air pollution emissions and hourly meteorological measurements. The concentration values were corrected according to measured values at five stations. This chapter provides a short review of the findings of the sub-investigations that dealt with these areas.

4.1 MEASURED CONCENTRATIONS OF AIR POLLUTANTS AND METEOROLOGY IN THE GRENLAND AREA

Measurements were taken of both air pollutant concentrations and dispersion conditions (meteorological parameters). The location of the stations is shown in Figure 4.1. This study is more fully described in Hagen and Hoem (1989).

Meteorological conditions were measured at five stations. Measurements included wind direction, wind speed, temperature, temperature difference with height, humidity, gust, and fluctuation in wind direction. The results show that wind is channelled through the local topographical nature of the terrain. However, at a height of 100 to 125 meters above ground, wind direction is no longer affected by the underlying terrain. In the winter of 1988 (January to March), wind measurements at Ås showed that wind came more from the southeast than is normal in the winter. This winter was also unusually mild. In the summer of 1988 (April to June) the frequency of wind from the southeast and northwest was greater than normal.

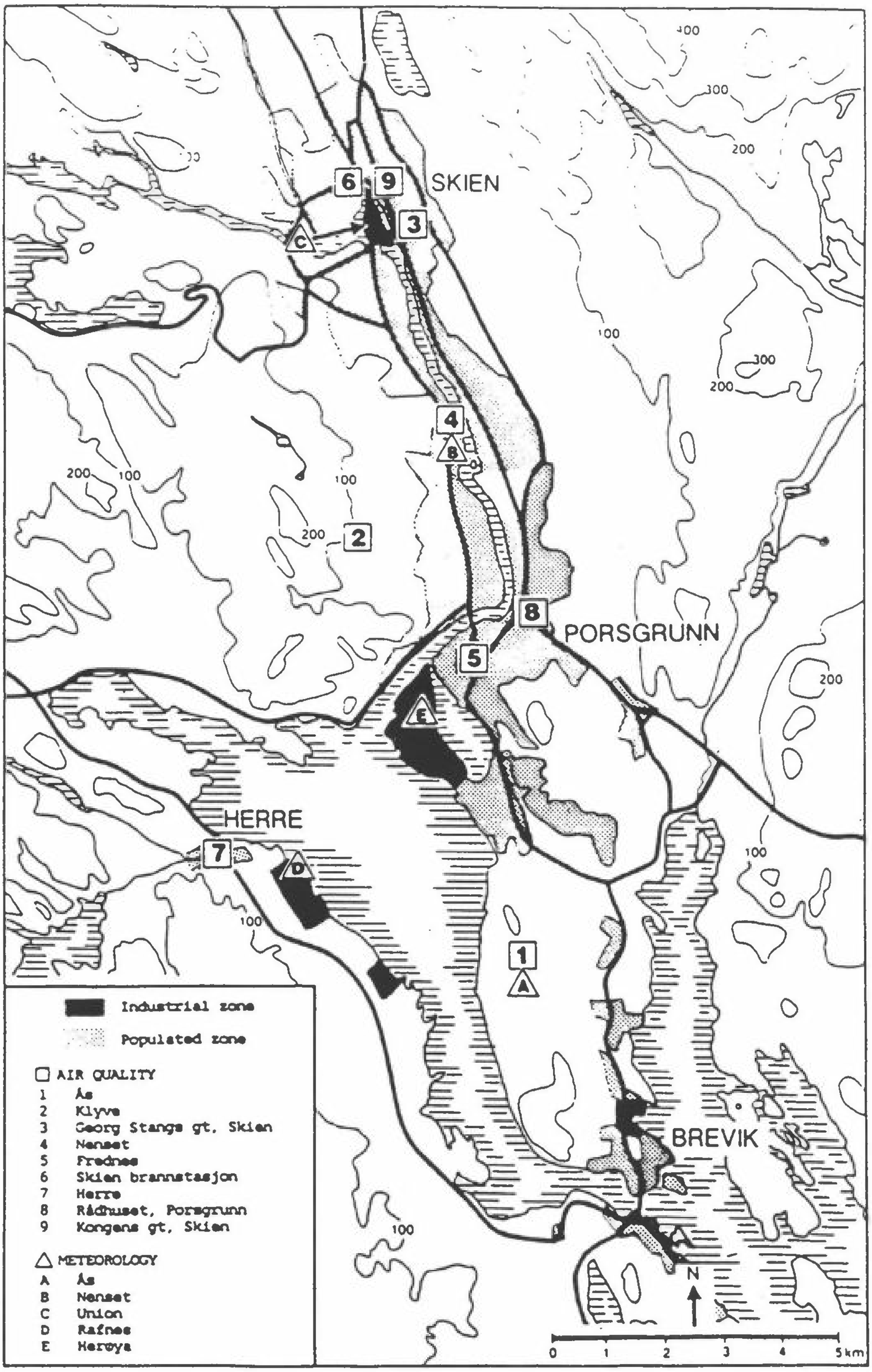


Figure 4.1: Location of the stations for measurements of air quality and meteorological parameters.

In the winter of 1988, there was a greater frequency of unstable or neutral weather situations than is normal for this time of year. This meant that pollution dispersion was much better than in an average winter, resulting in lower pollution concentrations. Stable weather situations occurred mostly during the nights in the summer. However, dispersion was on the average quite good in the summer. The typical land-sea breeze was observed.

Air pollutant concentrations were measured at nine stations, with continuous hourly measurements of some compounds at five of the stations. Measurements included: 1) hourly: sulfur dioxide, nitrogen oxides, ozone, haze (dispersion coefficient b_{scat}) and 2) 12-hourly: suspended particles, sulfate, nitrate, chloride, and pollen. It is not practical to measure the second group on an hourly basis.

Air quality measurements in 1988 revealed lower concentrations of air pollutants than were measured by the monitoring program in 1986 and 1987. This was primarily due to reduced emissions from heating because of the mild winter and to the better than usual dispersion conditions.

A summary of the results of the air pollutant concentration measurements is given in Tables 4.1 and 4.2. In the first table the maximum concentrations measured at the different stations are given for each of the different averaging times. The other table shows how often air quality guidelines for Norway (SFT, 1982)or for the World Health Organization (WHO, 1987) were exceeded.

Measurements of air quality in Grenland during the period January to June 1988 showed that air quality guidelines for SO_2, NO_2, O_3, soot and suspended particles were exceeded in some instances. Ozone was the compound that exceeded the guidelines most often. For SO_2, the guidelines were exceeded most often in Skien and in the winter. The compound that exceeded the guidelines most was SO_2 at Skien brannstasjon. This was due to industrial emissions from a nearby factory.

Table 4.1: Summary of maximum values of some of the measured air pollution components during the period January to June 1988.

Component	Averaging time	Ås	Herre	Frednes	Klyve	Rådhuset Porsgrunn	Nenset	G.Stangs gt. Skien	Skien brannst.	Kongensgt. Skien
SO_2 ($\mu g/m^3$)	1 hour 24 hours	147 32	 23	338 37	474 55	 26	203 63	872 134	2027 320	 121
NO_x[1] ($\mu g/m^3$)	1 hour 24 hours	296 110		761 320	326 104		820 273	463 167	551 229	
NO_2 ($\mu g/m^3$)	1 hour 24 hours	192 84		119 70	191 75		125 61	102 47	121 59	 90
Haze (10^{-6} m^{-1})	1 hour 24 hours	764 116			1061 71			572 58		
O_3 ($\mu g/m^3$)	1 hour 8 hours	185 179			150 141					
Suspended particles ($\mu g/m^3$)	12 hours	69		89	74		93	94		
SO_4^{2-} ($\mu g/m^3$)	12 hours	16,7		16,2	17,8		16,3	15,3		
NO_3^- ($\mu g/m^3$)	12 hours	10,7		9,8	12,7		6,4	5,9		
Cl^- ($\mu g/m^3$)	12 hours	6,6		4,7	3,3		4,6	5,0		

1) Measured as a NO_2-equivalent.

Long-range transport of air pollution from other parts of Europe resulted in episodes of increased concentrations of SO_2, NO_2, soot, O_3, and haze, suspended particles and SO_4^{2-} in Grenland. The overall highest SO_4^{2-} concentrations were at all stations during just such an episode in the middle of February, 1988. Ozone also originates from long-range transport of air pollution.

Table 4.2: Number of hours and days when air quality guidelines for SO_2, NO_2, O_3, soot and suspended particles were exceeded during the winter (W), January-March, and during the summer (S), April-June 1988.

Component		SO_2		NO_2		O_3	O_3	Suspended particles
Averaging time		1 hour	24 hours	1 hour	24 hours	1 hour	8 hours	24 hours
Air Quality Guideline		350 µg/m^3 WHO	100 µg/m^3 Norway	200 µg/m^3 Norway	100 µg/m^3 Norway	100 µg/m^3 Norway	100 µg/m^3 Norway	70 µg/m^3 Norway
Ås	(W)	0	0	0	0	0	0	0
	(S)	0	0	0	0	406	35	0
Herre	(W)		0					
	(S)		0					
Frednes	(W)	0	0	0	0			
	(S)	0	0	0	0			
Klyve	(W)	1	0	0	0	0	0	0
	(S)	0	0	0	0	325	25	0
Rådhuset,	(W)		0					
Porsgrunn	(S)		0					
Nenset	(W)	0	0	0	0			0
	(S)	0	0	0	0			0
Georg Stangs gt,	(W)	6	1	0	0			0
Skien	(S)	0	0	0	0			0
Skien	(W)	6	2	0	0			
brannstasjon	(S)	0	0	0	0			
Kongens gt,	(W)		1		0			
Skien	(S)		0					

The results compound by compound are the following:

<u>Sulfur dioxide</u>

The tables show that SO_2 is a local problem in Skien and is due to industrial emissions. The highest hourly average of SO_2 was measured at Skien brannstasjon (2 027 µg/m^3) and was nearly six times higher than the WHO air quality guideline of 350 µg/m^3.

The highest daily average of 320 $\mu g/m^3$ was more than three times higher than the Norwegian proposed guideline of 100 $\mu g/m^3$.

The measuring stations were very little affected by the industrial emissions at Herøya in Porsgrunn.

Nitrogen dioxide

The highest daily average of NO_2 was measured in Kongens gt. in Skien and was caused by traffic pollution there. Average values for one and three months show lower values for stations that are less influenced by traffic pollution. The stations at Ås and Klyve, however, are at times clearly influenced by industrial emissions from Herøya, and these emissions were responsible for the highest hourly averages at the two stations. However, the air quality guidelines were not exceeded.

Haze

Small particles in the atmosphere spread light. Measurement of the dispersion coefficient (b_{scat}) is a convenient method for characterizing the haze caused by the different concentrations of particles. Measurements indicated approximately the same average amount of haze in winter and in summer. There were also only small differences between stations. The highest values of haze corresponded to the smallest meteorological visibility of around 4 km.

Ozone

The concentration of ozone was, as expected, highest in the summer. Measurements showed the same values measured both at Klyve and at Ås. Both the Norwegian and WHO guidelines for air quality were exceeded rather often during the summer. The source of ozone is primarily long-range transport of air pollution.

Pollen from birch and grass

There was intensive flowering of birch for one week in the middle of May with pollen values being highest in the morning. Grass had just begun to bloom when the study was finished at the end of June.

Suspended particles

The concentrations of suspended particles (particles with diameter less than 10 μm) differed only slightly between stations. Values measured in the winter were only slightly higher than those measured in the summer. Most of the dust was on the smallest particles (diameter less than 2.5 μm). These particles may when inhaled reach the lung alveoli. Only once was the WHO guideline of 70 $\mu g/m^3$ exceeded.

Sulfate, nitrate and chloride in suspended particulate matter

Concentrations of sulfates were generally lower in 1988 than in either 1986 or 1987. There were small differences between stations. The highest values were measured in the period from February, 15 to 17, during a period of long-range transport of air pollution. On an average more than 90% of all sulfate was found in the smallest particle class.

The highest daily averages of nitrates and chloride were measured at Klyve and Ås when wind came from the industrialized area of Herøya. A relatively large portion of nitrate and chloride was found in the largest particle class.

4.2 THE RELATIONSHIP BETWEEN INDOOR AND OUTDOOR CONCENTRATIONS OF AIR POLLUTANTS

People usually spend over 80% of their time indoors. Therefore it is of primary importance to know the exposure to indoor air contaminants. It is important to quantify how much of outdoor air pollution penetrates into the home, and what kinds of indoor sources of air pollution might exist. In Norway, gas cooking and heating is non-existent, and therefore not an indoor source of nitrogen oxides. The single most important factor for indoor pollution is smoking. Compounds differ in the degree to which they react to the surfaces of walls, furniture, textiles, carpets etc. Such surface interactions have an impact on indoor concentrations of some compounds.

In order to be able to calculate the exposure to each pollutant for all the participants in the study, one had to establish the relationships between indoor air and outdoor air concentrations of the pollutants. This was done by simultaneous measurements of indoor and outdoor air at each home. A total of 15 homes was investigated. The indoor measurements in each home were carried out in the living room. A mobile unit with all the necessary equipment and instruments was utilized for simultaneous measurements of indoor and outdoor air (Braathen, 1989a, 1989b, 1991).

The following relationships were used in the exposure model for estimating indoor air:

SO_2 (sulfur dioxide)

Despite three major industrial sources of SO_2 emissions in the Grenland area, 8-hour concentrations of SO_2 were low both outside and inside all homes, including the homes situated close to one of the industrial sources. This was probably because no home was located in a plume long enough to significantly raise the 8-hour concentrations. The highest outdoor air SO_2 concentration that was measured was 63 $\mu g/m^3$, and the highest indoor air concentration was 70 $\mu g/m^3$.

In general, there were no significant differences between the SO_2 concentrations in the indoor and outdoor air of the homes. Therefore, a ratio equal to 1 between SO_2 concentrations indoors and outdoors was chosen when the outdoor air concentration was lower than 10 $\mu g/m^3$.

At higher outdoor concentrations a ratio of about 0.5 has been reported (Benson et al., 1972, Seifert, 1982, Johansson, 1982). Assuming an indoor air concentration of 500 $\mu g/m^3$ with an outdoor air concentration of 1 000 $\mu g/m^3$, results in the following relationship between indoor (C_{in}) and outdoor (C_{out}) concentrations for all homes in both seasons:

$$\boxed{C_{in} = 0.49 \cdot C_{out} + 5.05} \qquad (C_{out} > 10\ \mu g/m^3)$$

where the concentration unit is $\mu g/m^3$.

NO_2 (nitrogen dioxide)

In most Norwegian homes, there are no significant NO_2 sources indoors. Since NO_2 reacts with active surfaces in the indoor environment, this means that indoor concentrations of NO_2 generally will be lower than outdoor concentrations. The highest 8-hour concentration measured outdoors was 86 $\mu g/m^3$, and the highest indoor concentration was 59 $\mu g/m^3$.

Table 4.3 shows the relationships between the indoor (C_{in}) and outdoor (C_{out}) concentrations of NO_2.

The regression slopes in Table 4.3 are all smaller than 1. The slopes in homes with inhabitant(s) suffering from lung disease are larger than in homes without such inhabitants, and this is presumably due to higher air exchange rates in homes where one of the inhabitants is suffering from lung disease.

Table 4.3: Relationship between indoor (C_{in}) and outdoor (C_{out}) concentrations of NO_2 in Norwegian homes (r = correlation coefficient).
Unit: $\mu g/m^3$.

<table>
<tr><th>Season</th><th>Time interval</th><th>Home with inhabitant(s) suffering from lung disease</th><th>Home without inhabitant(s) suffering from lung disease</th></tr>
<tr><td rowspan="2">Winter</td><td>0000-1600</td><td colspan="2">$C_{in} = 0.28 \cdot C_{out} + 6.30$, r=0.67</td></tr>
<tr><td>1600-2400</td><td>$C_{in}=0.35 \cdot C_{out}+6.50$, r=0.49</td><td>$C_{in}=0.21 \cdot C_{out}+10.50$, r=0.69</td></tr>
<tr><td rowspan="2">Summer</td><td>0000-0800</td><td colspan="2">$C_{in} = 0.56 \cdot C_{out} + 7.50$, r=?</td></tr>
<tr><td>0800-2400</td><td>$C_{in}=0.81 \cdot C_{out}+1.50$, r=0.89</td><td>$C_{in}=0.34 \cdot C_{out}+9.55$, r=0.67</td></tr>
</table>

In homes without significant NO_2 sources, indoor/outdoor concentration ratios between 0.4 and 1.0 have been reported (Moschandreas et al., 1981; Yocom, 1982; and Sexton et al., 1983). The calculated ratios in Norwegian homes in the winter were between 0.4 and 0.6 with an assumed outdoor air concentration of 30 $\mu g/m^3$. In the summer the ratios were generally larger than in the winter because air exchange rates were higher.

Suspended particles, fine fraction

The fine fraction of the suspended particles contains particles with diameter less than about 2.5 µm. These particles have both indoor and outdoor sources. Tobacco smoking in the indoor environment may increase the concentration of the fine fraction substantially.

In order to assess the penetration of fine particles from outdoor air into indoor air of the homes, it is presumably advantageous to study the concentrations of fine fraction SO_4^{2-} (sulfate) indoors and outdoors. The reason for this is the absence of important indoor sulfate sources. The slopes of the lines of regression for fine fraction sulfate (see below) were therefore also used for the fine fraction itself.

The average indoor air concentrations were then calculated, and the lines were adjusted so that, with an outdoor air concentration of 25 µg/m^3, the calculated indoor air concentrations would be equal to the average concentrations for the fine fraction.

The average indoor air concentrations that were used, are shown in Table 4.4.

Table 4.4: Average indoor air concentrations of the fine fraction of the suspended particles (µg/m^3) in 15 homes in Grenland.

Season	Time interval	Home with smoking of more than 10 cigarettes a day	Home with smoking of 1-10 cigarettes a day	Home with no smoking
Winter	0800-2000	116	55	17.5
	2000-0800	78	40.5	14.5
Summer	0800-2000	64	27	19
	2000-0800	55	23	13

Indoor/outdoor concentration ratios (I/O) between 0.4 and 5.0 have been reported (Seifert, 1982; Moschandreas et al., 1981; Spengler et al., 1981). In this study, I/O ratios between 0.5 and 4.5 were calculated assuming an outdoor air concentration of the fine fraction of 25 µg/m^3 and the values given in Table 4.4.

SO_4^{2-} (sulfate), fine fraction

In outdoor air the concentration of fine fraction SO_4^{2-} (sulfate) is generally considerably higher than coarse fraction SO_4^{2-}. Since there is no important indoor source of SO_4^{2-}, the same is expected to be true for sulfate in indoor air, and this was found in the present study.

On the fine fraction, the highest outdoor 8-hour concentration of SO_4^{2-} that was measured was 11.4 µg/m³ and the highest indoor concentration was 9.6 µg/m³.

For the fine fraction, the regression equations of the indoor concentrations of SO_4^{2-} on the outdoor concentrations are shown in Table 4.5.

Table 4.5: Regression equations of the indoor concentration (C_{in}) of SO_4^{2-} (sulfate) on the outdoor concentration (C_{out}) for the fine fraction of the suspended particles (r = correlation coefficient). Unit: µg/m³.

Season	Time interval	Home with inhabitant(s) suffering from lung disease	Home without inhabitant(s) suffering from lung disease
Winter	0800-2000	$C_{in} = 0.73 \cdot C_{out} + 0.32$, r=0.89	
	2000-0800	$C_{in} = 0.70 \cdot C_{out} + 0.23$, r=0.78	
Summer	0800-2000	$C_{in}=0.87 \cdot C_{out}+0.94$, r=0.95	$C_{in}=0.75 \cdot C_{out}+0.43$, r=0.92
	2000-0800	$C_{in} = 0.72 \cdot C_{out} + 0.26$, r=0.98	

With an assumed outdoor concentration of 3.0 µg/m³, the calculated indoor/outdoor concentration ratios (I/O) were between 0.6 and 1.2 with the highest value occuring in daytime in the summer in homes with an inhabitant suffering from lung disease. This was the only I/O that was higher than 1, and it is difficult to find a plausible explanation for this high value. In the literature, indoor/outdoor concentration ratios between 0.3 and 1.0 have been reported (Moschandreas et al., 1981; Spengler et al., 1981; Yocom, 1982; Dockery and Spengler, 1981). The measured concentrations indoors and outdoors and the line of regression for fine fraction SO_4^{2-} (sulfate) for the time interval 0800-2000 in the winter are shown in Figure 4.2.

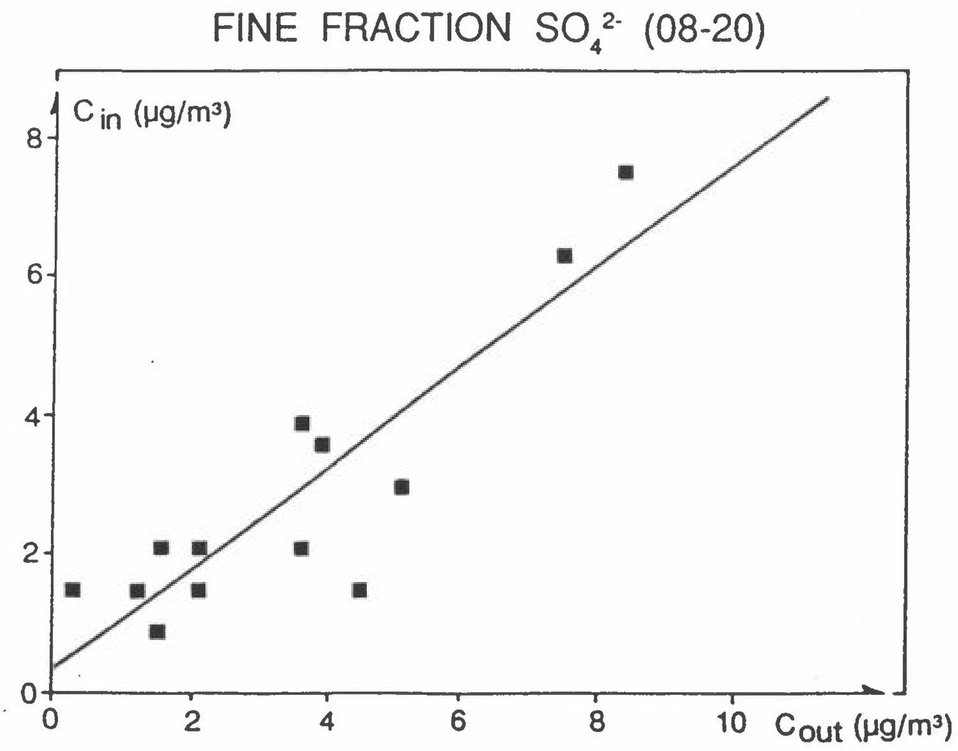


Figure 4.2: The indoor air versus outdoor air concentrations and the line of regression for fine fraction SO_4^{2-} for the time interval 0800-2000 in the winter in 15 homes in the Grenland area.

4.3 DISPERSION MODELLING OF OUTDOOR QUALITY FOR THE ENTIRE STUDY AREA

In a study of this kind where hour for hour symptomatology is correlated with exposure to air pollution, it is essential to have as good an estimate of exposure as possible.

The major difficulty in estimating exposure is that people move about so much. In order to handle this, air pollution modelling of the entire geographical area was incorporated into this study.

Even though a large amount of information has been collected on the pollution situation hour by hour and measuring stations have been located to represent the area, this is not enough. Emissions from large chimneys follow wind and are diluted as a result of turbulence and time variations in wind conditions. Pollution concentrations can therefore vary substantially over short distances.

An air pollution dispersion model was used in Grenland. Data on emissions, wind and turbulence were gathered to calculate the distribution of pollution concentration in a geographical area. All the factories in the area gave detailed information on emissions of all major contaminants, some on an hourly basis. In addition, questionnaires were sent to all companies to detail their use of oil for heating. Traffic counts were used to estimate contamination from vehicular traffic along the major roads and streets. Finally, pollution from ship traffic up and down the fjord was also accounted for (Haugsbakk and Grønskei, 1989).

The dispersion model was used to calculate the concentrations of SO_2, NO_x and particles for each hour and each day for each square kilometer in the area. Background concentrations were estimated using stations far from major pollution sources. Ozone pollution stems from long-range transport. Since ozone reacts with NO to form NO_2, ozone concentrations decrease with increased NO. Ozone values in each square kilometer were corrected for calculated concentrations of NO. Twelve hour concentrations of sulfate and nitrate were interpolated using meteorological parameters for the entire area.

The model estimates of spatial outdoor concentration distribution for each of these pollutants were then adjusted to the actual measured values in the five square kilometers where the measuring stations were located.

The principal sources of error that explain differences between estimated and observed concentrations are:

Errors as a result of input data on an hourly basis:
- sources outside the area
- emissions from areal sources
- emissions from single sources
- horizontal wind field
- vertical exchange parameters

Errors as a result of dispersion model formulation:
- subgrid distributions
- description of vertical exchange
- errors in the location of the spatial concentration distribution.

Model estimates showed relatively good correlation with observed concentration for NO_x, and less for SO_2 (mostly attributed to problems associated with poorly known emission intensities of low level sources at the principal factory in the area) and suspended particles. More details on the air pollution dispersion model used in this investigation is described in Grønskei et al., 1990.

5 DESCRIPTION OF THE MODEL DESIGNED TO ESTIMATE INDIVIDUAL EXPOSURE

An individual's exposure to a contaminant is a function of the concentration in the micro-environment that he/she is in at the moment, the geographic area, its proximity to heavy traffic, being indoors or outdoors, travelling or shopping, etc. For some components whether people are smoking in individual's proximity can also influence exposure. Therefore, a micro-environment can be a city sidewalk, out in the woods, indoors at home, indoors at work, at a lunchroom at work, in a restaurant or at the movies, etc. Without doubt personal monitors are the preferred method to measure exposure. However, this is impractical when several compounds are being studied simultaneously. In addition, it is uncertain how much people change their routines when they have to carry such portable equipment. It is therefore more useful to use computer modelling coupled to the use of diaries to estimate each individual's exposure to each pollutant for each prescribed time span. In this study, it was decided to use the hour as the time unit. This is a unit that reflects major changes in micro-environments without having to use a diary that is impossible for people to fill out.

The major elements of an exposure model are therefore: geographic location; proximity to traffic; being indoors or outdoors; shopping; or travelling. These elements were incorporated in a computer model that is briefly summarized in Table 5.1 and Figure 5.1.

Table 5.1: Overview over factors included in calculating exposure to air pollution compounds and to meteorological parameters.

Compound	Outdoor value unchanged if window open	Outdoor value altered if window closed	Indoor Air Factor Accounted for				Factor to* Account for Extra Pollution from Traffic
			Season	Time of day	Home with asthmatic living there	Smoking in home	
POLLUTANTS							
SO_2	Y	Y	N	N	N	N	N
NO_2	Y	Y	Y	Y	Y	N	Y
NO	Y	Y	Y	Y	Y	N	Y
O_3	Y	Y	N	N	N	N	Y**
Particles	Y	Y	Y	Y	N	Y	Y
CO	Y	Y	N	N	N	N	Y
Cl_x	Y	Y					N
Nitrate	Y	Y	Y	Y	Y	N	N
Sulfate	Y	Y	Y	Y	Y	N	N
Pollen	Y	Y	NA****	N	N	N	N
METEOROLOGICAL PARAMETERS							
Temperature	N	Y	N	N	N	N	N
Humidity	N	Y	N***	N	N	N	N

NA = Not Applicable, Y = Yes, N = No.
* Only for those who live in the central parts of the two towns.
** Value of ozone reduced to 0 when NO concentrations are high.
*** Algorithm used differed according to ambient humidity.
**** Measured only in the summer.

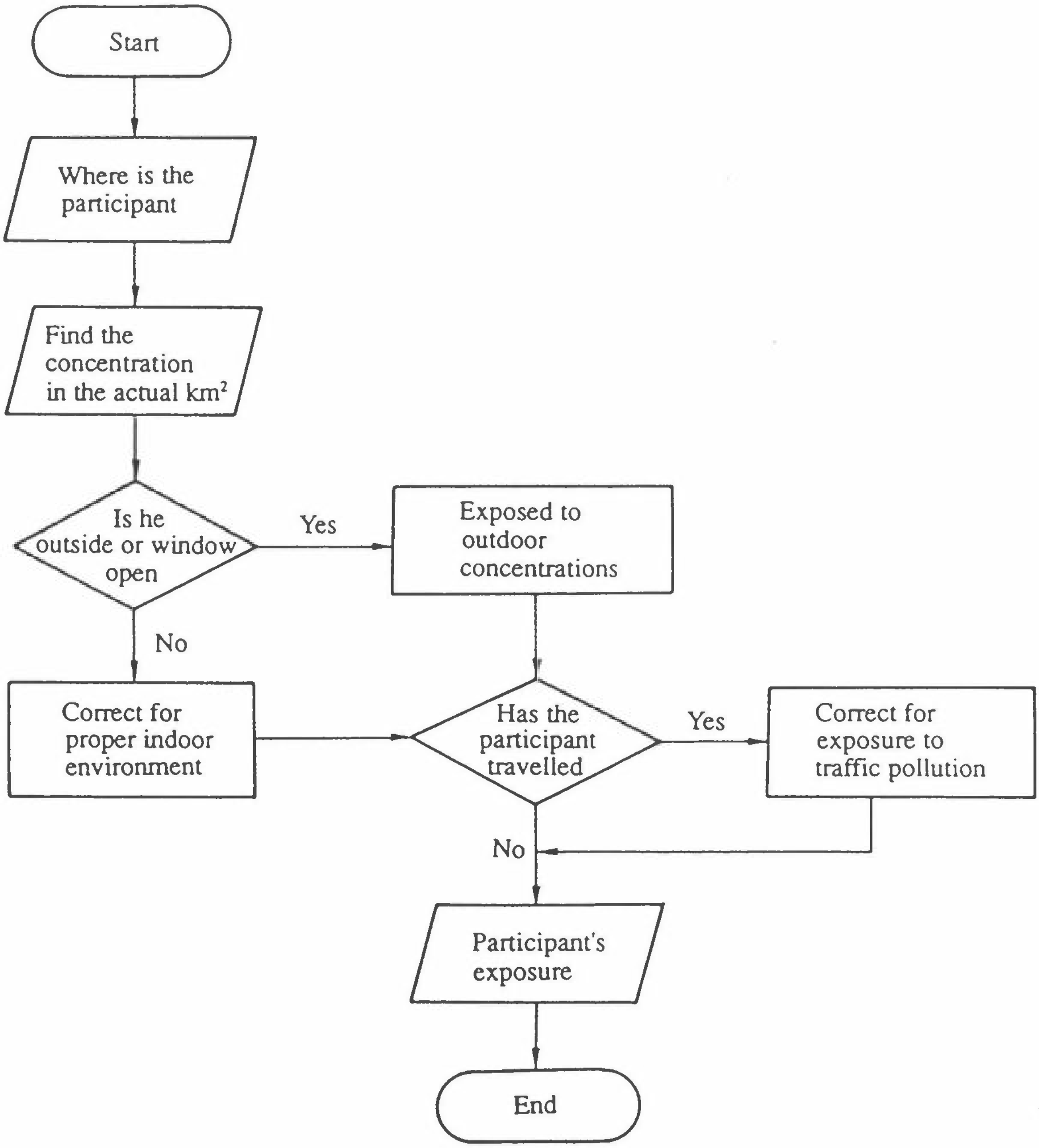


Figure 5.1: Overview of the program for estimation of each participants exposure, based on information from the diary.

Geographical location

The Grenland area has been chosen for this investigation because of its special pollution situation. Air pollution in the Grenland area is determined by several industrial sources that are widely spread in the region (Figure 4.1), long-range transport from outside the region, vehicular and ship traffic. These pollution sources combined with meteorological information were the ingredients in a model (described in Chapter 4) that estimated concentrations of each pollutant for each km^2 for each hour of each day for a 4 to 5 month period.

The combination of widely spread industrial sources emitting different compounds and a land-sea breeze leads to a situation where the population living spread over the area can be exposed differently at the same time of day. For example, people living north of Skien can be more exposed to emissions from both industrial complexes during the afternoon, but only slightly exposed in the evening. Those living north of Porsgrunn, could, on the other hand, be exposed to emissions from only the complex in Porsgrunn (Herøya) during the day time but exposed only to those of Union in Skien in the evening. Those living south of Porsgrunn, could be exposed during the day time, to little pollution from these industrial sources but exposed to emissions from both of them in the evening.

The entire Grenland area was divided into a kilometer grid as seen in Figures 5.2 and 5.3 and Appendix 1. Each individual indicated his/her location in the diary (Figure 3.1). The addresses were later coded to the nearest km^2. Proximity to a major road was also accounted for. This allowed determining each individual's location for each hour with relative accuracy. Figures 5.2 and 5.3 indicate how many individuals had their homes and their workplaces in each of the km^2 grids.

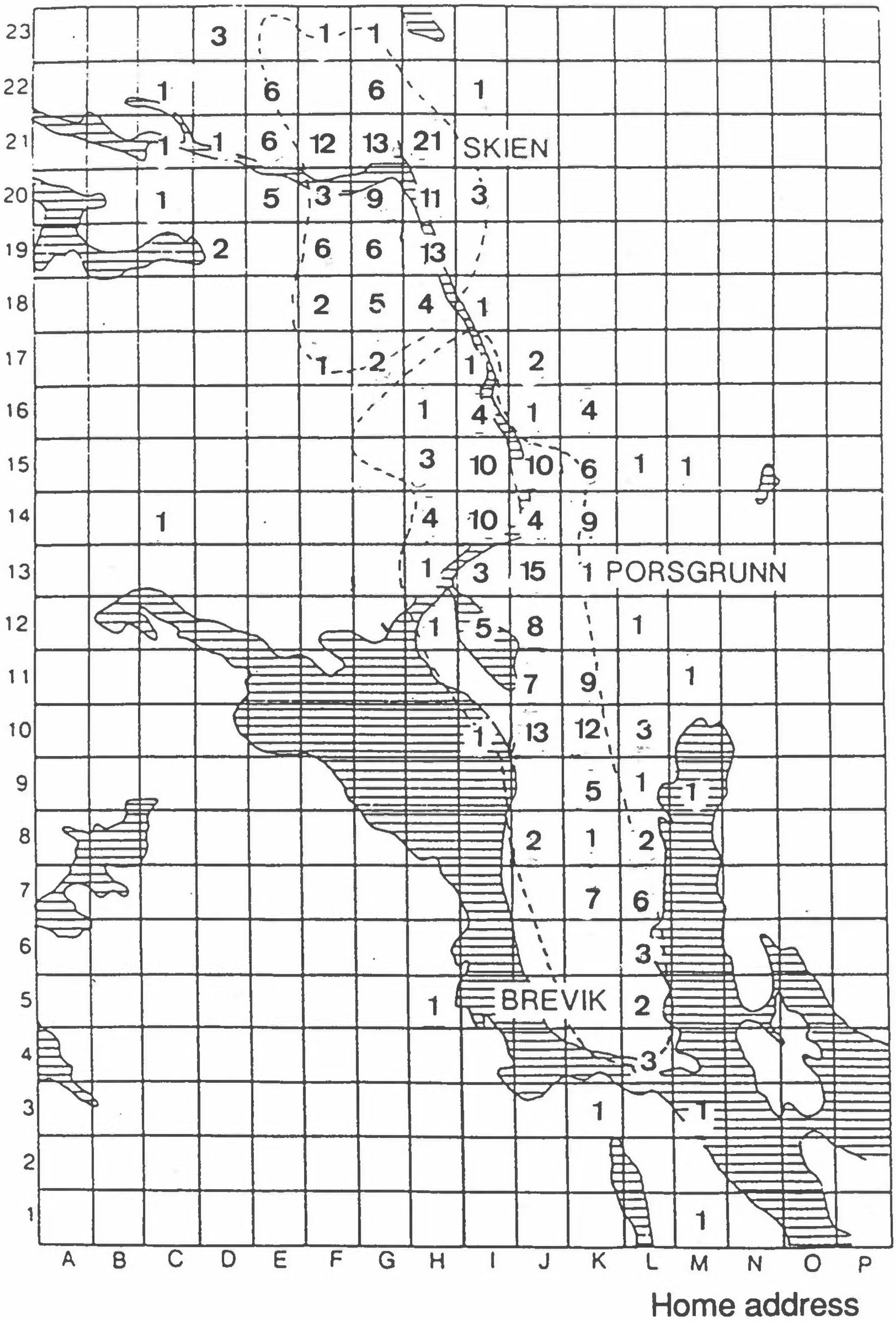


Figure 5.2: Participants' home address. Number of addresses in each square km.

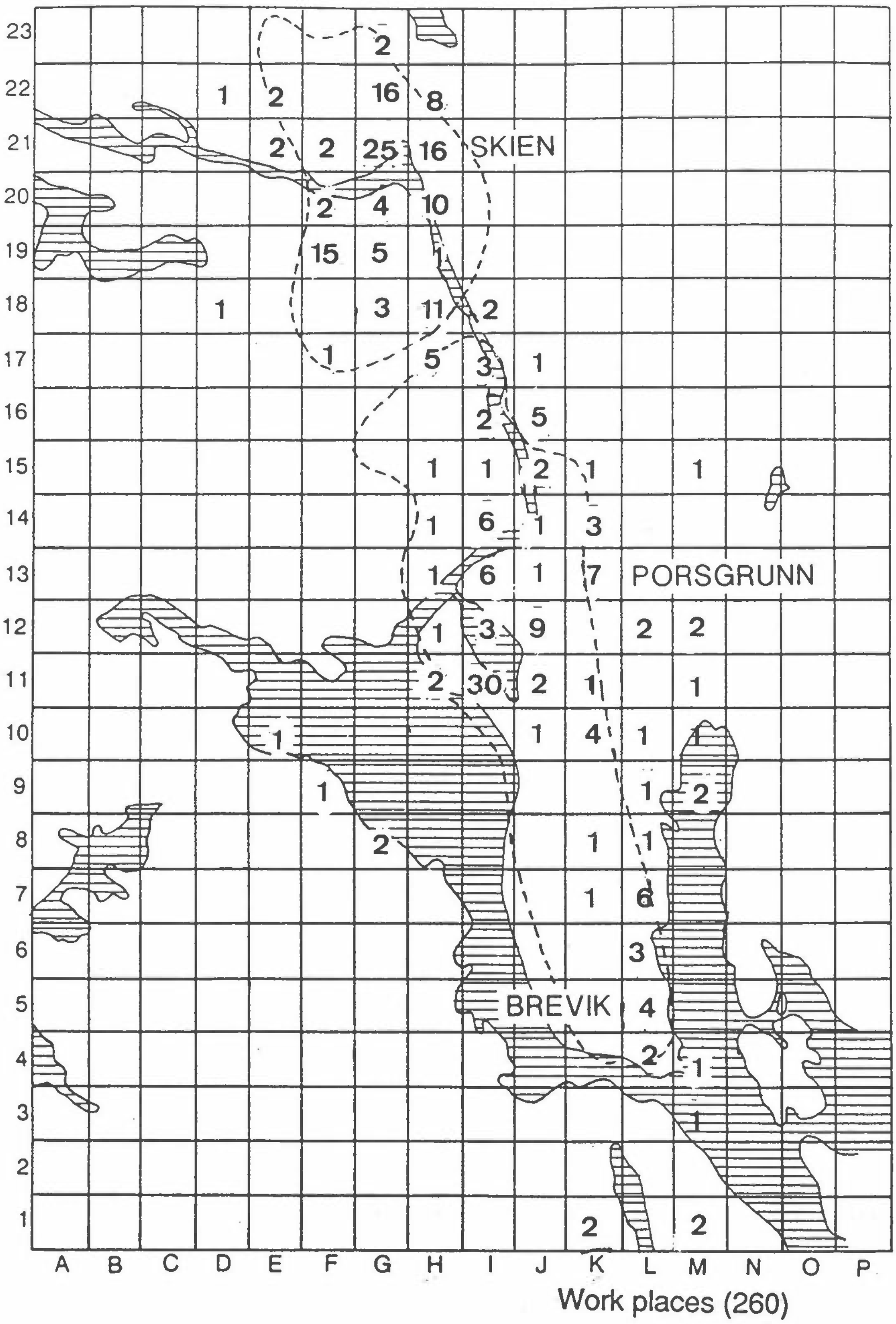


Figure 5.3: Participants' school and workplace. Number of addresses lying in each square km.

Shopping

If people are at home, at work or visiting for a relatively long period of time, it is not so difficult to say where they are. However, it is more difficult if they are shopping. Therefore, each person was given an alternative, that was to say that he/she was shopping either in Skien or Porsgrunn (the two major towns in the area) or other places. Since the two towns differ in sources and types of pollution, it was necessary to distinguish between them. Skien has a shopping area that is essentially free for traffic. In pollution estimating, if individuals indicated that they were shopping in Skien, an average of the squares that represent the shopping area was used. If, on the other hand, individuals indicated that they were shopping in Porsgrunn, an average of the km^2 in Porsgrunn were used, plus an additional factor for vehicular traffic, since the main shopping area is traversed by a major throughway.

Travelling

One of the major pollution sources that contributes to exposure is traffic. Therefore, it is necessary to know when people are travelling and how much traffic they are exposed to. Therefore, the participants were asked to indicate how many minutes they were travelling in little, medium or heavy traffic. It is obvious that much more information could have been requested to improve the estimate even more, but each question must be weighted by the extra difficulty imposed on the participant to fill out the diary. Therefore, efforts were made to concentrate on exposure to the most important sources of pollution.

In order to account for background pollution concentrations, an average of several km^2 reflecting air pollution concentrations in the entire area was used.

Indoor pollution

It is very important to know whether individuals are indoors or outdoors. Since this study spanned a 6 month period, it was expected that the amount of time spent outdoors, or indoors with windows and doors open, would vary during the investigation period. Participants were therefore asked to indicate for each hour whether or not they were indoors or outdoors, and if indoors, whether or not the windows were open in the room they were in. If they were outdoors or indoors with the windows open, their exposure was given as equal to outdoor pollution in the km^2 where they were for that hour.

However, if they were indoors, special algorithms were used for each component as described in Chapter 4. Conditions indoors can vary between climatic zones and countries dependent of building qualities, age etc. and culture. Depending on the compound, indoor concentration was dependent on time of day, smoking in the home or that a person with pre-existing lung disease was living there. As described in Chapter 4.2, having such a person living in the home led to greater ventilation rate of the home which influenced some compounds. Smoking increased concentrations of particles and since activity level can influence how much dust is floating in the air, time of day was also accounted for.

Active and passive smoking

Since smoking in the room was accounted for in the model, each individual was asked to indicate how many cigarettes that individual smoked himself, or if the participant was exposed to passive smoking from others. Again this information was obtained for each hour. The information on smoking is also to be used in the analysis of the health effects of air pollution.

In order to get a feel of how the exposure model functions, the model was run for 2 fictitious people, one person living in

Skien and working in Porsgrunn (Subject A), and one living in Porsgrunn and working in Skien (Subject B). More information on each of these subjects is given in Table 5.2. Air quality and meteorological data are used from real values measured on March 9, which was a high pollution day. To simplify this discussion only the compounds SO_2, NO_2, O_3 and suspended particles (fine fraction) will be described in detail.

Table 5.2: Details of the 2 fictitious individuals used to test and describe the model.

A) TIME PLAN FOR BOTH SUBJECT A AND B

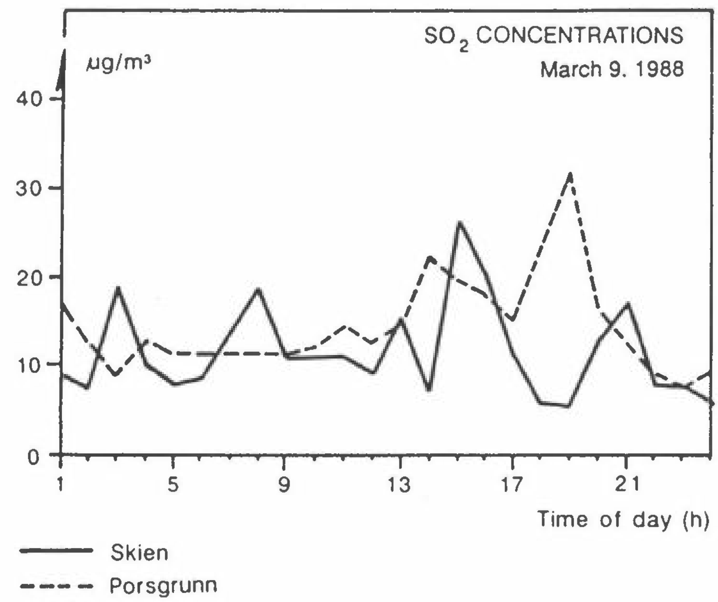
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Home	—	—	—	—	—	—												—	—	—	—	—	—	—
Window open	—	—	—	—	—	—																		—
At work								—	—	—	—		—	—	—	—								
Travelling							—										—							
Shopping in local area												—												
Smoking - passive													—					—	—	—				

B) EXTRA INFORMATION ON SUBJECTS A AND B

	Subject A	Subject B
Home	Skien (H-21)	Porsgrunn (H-14)
Work	Porsgrunn (I-13)	Skien (G-21)
Presence of heavy traffic near workplace	Yes	No
Travelling (H:M:L)* morning	20:30:10	30:20:10
Travelling (H:M:L) afternoon	30:20:20	20:30:20
Shopping	Porsgrunn	Skien
Nearest measuring station - home	G. Stangsgt.	Klyve
Nearest measuring station - work	Frednes	Brannstasjon

H = heavy, M = medium, L = light traffic, in minutes.

As indicated previously, the main factors that affect the model calculations are which geographic region the participant is in, whether or not the subject is indoors or outdoors, qualities of the home that may influence indoor air contaminant concentration and if the subject is being confronted with extra pollution because of proximity to traffic.



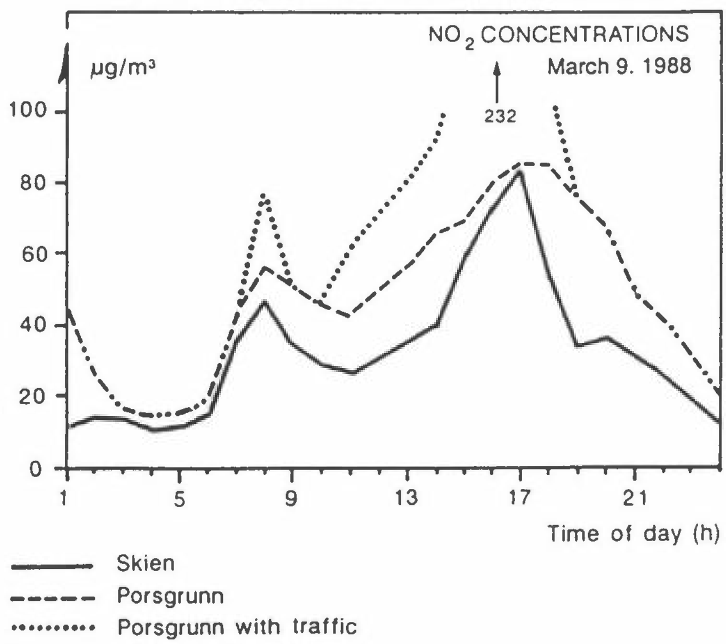


Figure 5.4: Estimated values for SO_2 and NO_2 on March 9, 1988 in Skien, Porsgrunn and Porsgrunn with an extra amount of pollution due to traffic.

An example of the effect of geographical region is shown in Figure 5.4 where the estimated values for SO_2 and NO_2 in the Skien area (used in calculating shopping in Skien) as opposed to those values calculated in Porsgrunn vary during the 24 hours. In addition, the effect on NO_2 values of adding traffic can be seen by comparing the values estimated in Porsgrunn if traffic is accounted for or not. With SO_2 the effect of changing wind directions can also be seen. SO_2 is primarily emitted at the Union factory (paper mills) in Skien. At 0300 and 0800 the wind is obviously blowing from the southwest up the valley leading to small puffs of SO_2 in Skien but not in Porsgrunn. From 1800 to 1900 the wind is primarily from the north leading to low values in Skien and high values in Porsgrunn.

The effect of smoking in homes in the estimating of particles is also shown in Figure 5.5. This type of contaminant has the most extensive set of algorithms since indoor concentrations were seen to depend on smoking and to the greater ventilation in homes where individuals with pre-existing lung disease lived. The difference due to ventilation is so small that it cannot be registered in this figure whereas the effect of smoking leads to values much higher than those measured outdoors.

In Figure 5.6 three values are compared: those values for exposure estimated by the exposure model, those values for the km^2 grid estimated by the dispersion model and finally those values measured at the nearest air quality measuring station. Since measuring stations were located both in Skien and in Porsgrunn, estimated km^2 and measured values are not usually that different. These graphs compare the exposures of the two individuals described in Table 5.2 for the compounds SO_2, NO_2, O_3 and suspended particles. For SO_2 the estimated model values of exposure and km^2 grid are well related with the exception of when the individuals are indoors with the windows closed. The pattern for the 24 hours is different between the two subjects. The differences between estimated and measured values are rather marked and indicate how important wind direction is so close to the factory. The NO_2 values are lower indoors than outdoors, and exposure to traffic pollution is the largest cause for deviation between the two model estimated values. The estimated and measured values are very similar to each other, which is not unexpected with the measuring station in the same area. O_3 values are lower indoors than outdoors and the difference between measured and estimated values is rather large since the measuring station is far from sources of NO_2 (used for modifying O_3 values). For suspended particles the estimated values are heavily influenced by smoking and exposure to traffic pollution whereas this effect is not so pronounced in the measured values because of the averaging time (12 hours).

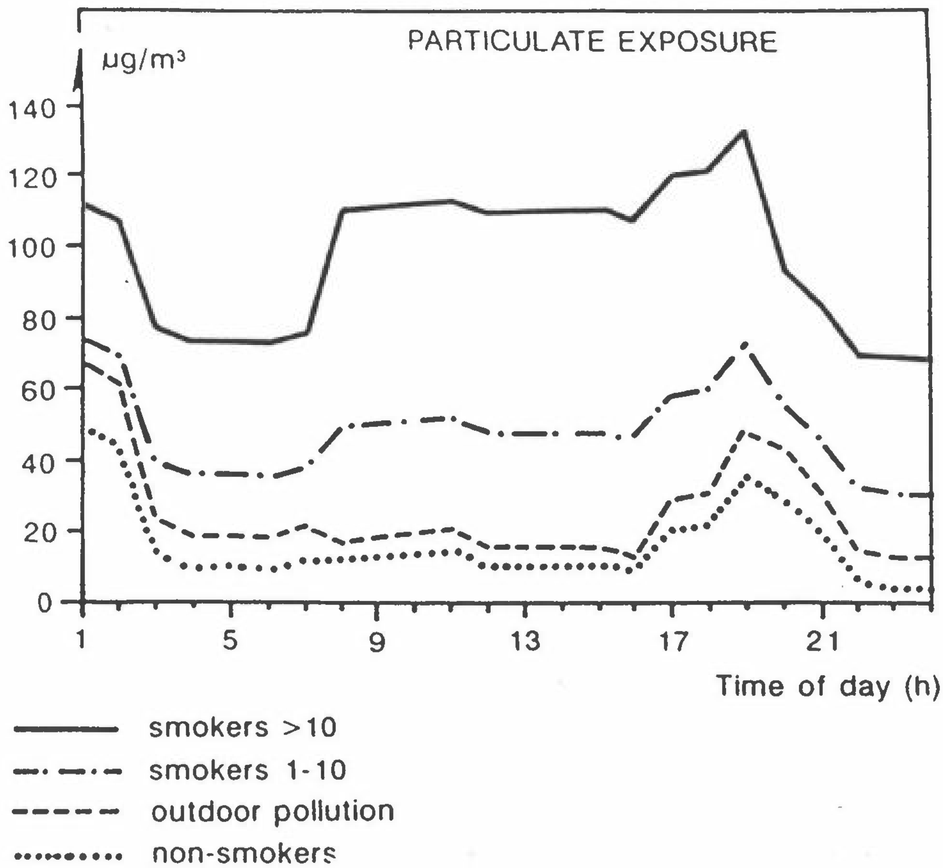


Figure 5.5: Effect of smoking in homes on estimates of exposure to suspended particles.

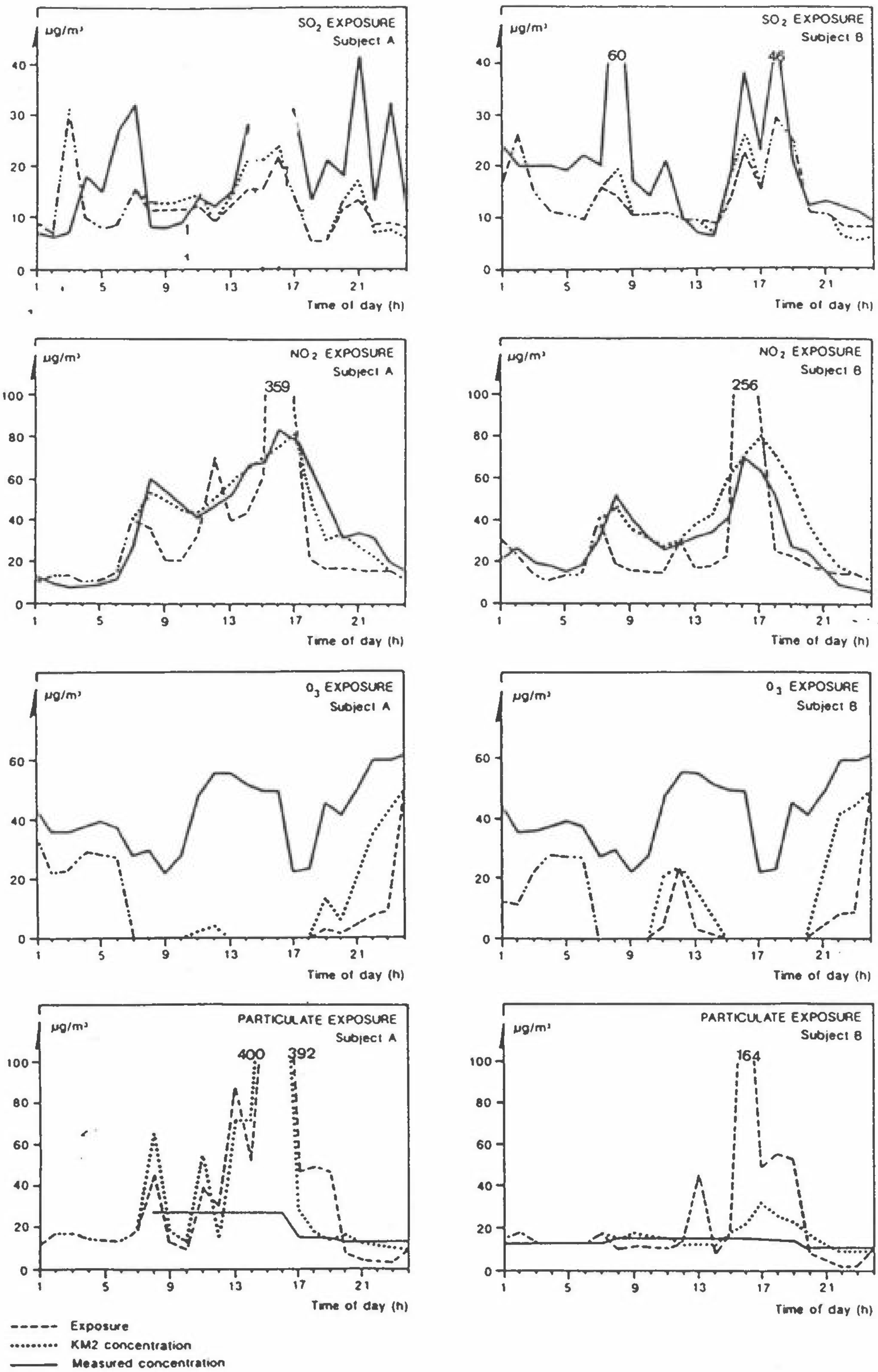


Figure 5.6: Comparison of exposure estimate, estimated value for nearest km² and that value measured at the nearest air pollutant monitoring station for SO_2, NO_2, O_3 and suspended particles for 2 fictitious individuals, March 9, 1988. Person A living in Skien and working in Porsgrunn, and person B living in Porsgrunn and working in Skien as described in Table 5.2.

There is no way of knowing if these corrections are truly correct but they reflect an attempt to account for the current state of knowledge in this field.

6 SUMMARIZED TIME BUDGET INFORMATION PROVIDED BY THE DIARY

One of the purposes of the diary was to establish which micro-environment each individual was in for each hour of the study. Air pollution was estimated for each of these micro-environments. As stated earlier, a micro-environment could include a city sidewalk, inside a car, in the house with windows closed, etc. The study was planned to go over two seasons, so that possible seasonal differences in amount of time spent in various micro-environments could be investigated. This chapter summarizes the results of time budget information provided by the individual diaries. This information can in many ways be considered typical for Norwegian lifestyle. It should be emphasized that the information described here is indicative only. Differences were not tested for statistical significance.

Comparing results of the health effects of air pollution in studies done in different countries where individual exposure has not been measured must be done carefully. Even though pollution levels may be higher in one country, exposure may be less due to cultural differences in ventilation of homes (e.g. sleeping with windows open) and time spent outdoors.

Each person of the present study was to categorize each indoor location he/she had been in (home, workplace, school, or other) by type according to the following classification:

House/appartment/office
Shop/store
Industrial area
Coffee shop, restaurant with smoking
Theater/sports hall without smoking
School/day-care center
Other.

Table 6.1 shows that people spend 83% of the time in a home or office in the winter, compared to 81% in the summer.

Table 6.1: Presence in each of a series of micro-environments in winter and summer.

Type location	Season			
	Winter		Summer	
	No. of hours	%	No. of hours	%
Not relevant (but includes shopping and travelling for less than 1 hour)	15693	3.5	15102	3.8
House/office	377224	83.0	324740	80.7
Shopping or travelling (full hour)	4348	1.0	3821	0.9
Industrial area	20709	4.6	17553	4.4
Coffee shop, restaurant etc. with smoking	2129	0.5	2162	0.5
Theater, sports hall etc. without smoking	4792	1.1	2769	0.7
School, day-care center	9709	2.1	8002	2.0
Other	19895	4.4	28504	7.1

In Table 6.2 one can see that when individuals say they are at work, 32.5% of the time that would be an office, whereas 36.5% of the time this would be an industrial location. Since the study area has several important factories, this is not so surprising. In addition, 7% of worktime was shops or stores and 9.5% schools, day-care centers or kindergartens. These per cents represent the % of hours all individuals say they are at work, therefore jobs where individuals work longer hours will be over represented.

Table 6.3 gives the same % distribution for time spent in miscellaneous places, that is neither own home nor school/work. Fifty-one per cent were not possible to be categorized in the winter and 60% in the summer, 33% in a home or office in the winter (31% in the summer), 3% in restaurants or coffee shops and 8% in movie theaters, sports halls etc. in the winter as opposed to 4% in the summer.

Table 6.2: Per cent of working hours in different types of locations.

Type of indoor location	Season			
	Winter		Summer	
	No. of hours	%	No. of hours	%
House/office	17708	32.5	12427	28.0
Shops	3835	7.0	3627	8.2
Industrial area	19915	36.5	16536	37.2
Coffee shop, restaurant etc. with smoking	629	1.2	715	1.6
Theater, sportshall etc. without smoking	253	0.5	301	0.7
School, day-care center	5185	9.5	4527	10.2
Other	7021	12.9	6286	14.2

Table 6.3: Per cent of time in miscellaneous places (not at home or school/work) by type of location.

Type location	Season			
	Winter		Summer	
	No. of hours	%	No. of hours	%
Not relevant (but includes shopping, travelling for less than 1 hour)	15693	28.3	15102	24.1
House or office	18499	33.4	19200	30.6
Shops	513	0.9	194	0.3
Industrial area	794	1.4	1017	1.6
Coffee shop, restaurant etc. with smoking	1500	2.7	1447	2.3
Theater, sportshall etc. without smoking	4539	8.2	2468	3.9
School, day-care center	1057	1.9	1038	1.7
Other	12874	23.2	22218	35.4

Tables 6.4 to 6.7 show the per cent of time spent at home, at school or day-care center or other places by weekday, month, population subgroup and sex. It is important to specify that in Norway in 1988, many stores close on weekdays between 1700 and 1800, at 1400 on Saturdays in the winter and 1300 in summer, and were closed all day on Sundays, but open a few hours longer on Thursdays. In addition, many jobs have different working

hours winter and summer with summer being shorter. This can be seen in this table, where time spent at work is slightly longer on Thursdays, longer winter than summer and longer Saturday than Sunday. Time spent at home is reduced in summer whereas time spent other places increases. It was surprising to note that children spend as much time at school as adults spend at work and that time spent at home or at work is the same in the two adult study groups. Adult women spend more time at home and less time at work than adult men.

Table 6.4: Per cent of time spent at home, at work, at school, etc. for each weekday winter and summer.

Season	Home		Workplace		School/ day-care center		Other places	
	N*	%	N	%	N	%	N	%
WINTER								
Weekday								
Monday	48 320	70.0	11 369	16.5	770	1.1	8 541	12.4
Tuesday	47 158	69.0	11 415	16.7	841	1.2	8 962	13.1
Wednesday	46 771	68.4	11 429	16.7	740	1.1	9 412	13.8
Thursday	46 372	67.9	11 598	17.0	849	1.2	9 461	13.9
Friday	46 389	67.9	11 004	16.1	605	0.9	10 354	15.1
Saturday	51 753	75.2	2 369	3.4	20	0.0	14 666	21.3
Sunday	53 932	78.4	1 347	2.0			13 481	19.6
SUMMER								
Weekday								
Monday	41 767	66.8	8 919	14.3	534	0.9	11 324	18.1
Tuesday	42 430	66.6	9 336	14.7	549	0.9	11 381	17.9
Wednesday	42 727	66.5	10 103	15.7	562	0.9	10 880	16.9
Thursday	42 541	65.6	9 308	14.3	583	0.9	12 464	19.2
Friday	41 640	64.0	9 480	14.6	499	0.8	13 493	20.7
Saturday	41 088	66.1	1 711	2.8	7	0.0	19 378	31.2
Sunday	40 647	65.3	1 019	1.6			20 590	33.1

* N = Number of hours.

Table 6.5: Per cent of time spent at home, at work, at school by month.

Month	% time home	% time at work	% time at school/ day-care center
January	73.1	12.7	0.8
February	72.4	13.0	0.9
March	64.6	12.7	0.6
April	71.9	12.4	0.8
May	68.4	10.8	0.7
June	65.9	12.6	0.5

Table 6.6: Per cent of time spent at home, at work, and at school by population subgroup.

Season	% time home	% time at work	% time at school/ day-care center
WINTER			
Population subgroups			
Randomly chosen adults	71.3	13.9	0.3
Children with lung disease	69.9	0.4	12.2
Adults with lung disease	76.2	10.9	0.1
SUMMER			
Population subgroups			
Randomly chosen adults	66.9	12.4	0.2
Children with lung disease	69.4	0.3	10.7
Adults with lung disease	71.8	10.8	0.2

Tables 6.8 to 6.11 show the per cent of time spent travelling, indoors with window closed or open and outdoors by weekday, month, population subgroup and sex. There is a sharp contrast in time spent with window open, closed or outdoors between winter and summer. Time spent travelling is basically stable. Even in the winter people spend an average of 17% of their time in rooms with window open and 3% of their time outdoors. In the summer, time spent outdoors can be as high as 20%. Children are more outdoors than adults, and adults with pre-existing lung disease have windows open more often and are more often outdoors, than the other adult study group. Women are outdoors less than men, but have window open more than men.

Table 6.7: Per cent of time spent at home, at work, and at school by sex.

Season	Type of location				
	Home	At work	At school/ day care center	Travels whole hour	Other places
WINTER					
Population subgroups					
Randomly chosen adults					
Sex					
Women	73.8%	9.7%	.5%	3.1%	12.9%
Men	66.0%	18.2%	.1%	3.5%	12.2%
Children with lung disease					
Sex					
Girls	63.3%		14.2%	1.8%	20.7%
Boys	72.2%	.7%	10.5%	2.7%	13.9%
Adults with lung disease					
Sex					
Women	79.4%	6.6%	.1%	3.5%	10.3%
Men	73.1%	13.8%	.0%	3.4%	9.7%
SUMMER					
Population subgroups					
Randomly chosen adults					
Sex					
Women	68.2%	8.7%	.3%	3.4%	19.3%
Men	61.4%	15.6%	.1%	3.4%	19.4%
Children with lung disease					
Sex					
Girls	61.5%	.2%	11.8%	3.0%	23.5%
Boys	69.1%	.3%	9.3%	3.0%	18.3%
Adults with lung disease					
Sex					
Women	71.9%	6.5%	.4%	3.3%	17.9%
Men	67.3%	13.3%		3.4%	16.0%

Table 6.8: Per cent of time spent indoors with window open and closed, and outdoors by season and weekday.

Season	Travelling		Indoors		Indoors with window open		Outdoors	
	N*	%	N	%	N	%	N	%
WINTER								
Weekday								
Monday	1 734	2.6	52 672	78.0	11 387	16.9	1 692	2.5
Tuesday	1 702	2.5	52 085	77.7	11 451	17.1	1 765	2.6
Wednesday	1 965	3.0	51 638	77.6	11 401	17.1	1 560	2.3
Thursday	2 161	3.2	51 539	77.2	11 523	17.3	1 534	2.3
Friday	2 494	3.7	51 522	77.5	10 981	16.5	1 521	2.3
Saturday	3 337	5.0	49 873	74.3	12 084	18.0	1 867	2.8
Sunday	2 292	3.4	49 776	74.1	12 779	19.0	2 297	3.8
SUMMER								
Weekday								
Monday	1 768	3.0	27 952	46.8	21 513	36.0	8 466	14.2
Tuesday	2 172	3.6	28 609	47.0	21 811	35.8	8 277	13.6
Wednesday	1 839	3.0	29 749	48.6	22 029	36.0	7 577	12.4
Thursday	2 433	3.9	28 090	45.5	22 231	36.0	9 028	14.6
Friday	2 298	3.7	28 760	46.9	21 467	35.0	8 855	14.4
Saturday	2 683	4.6	23 539	40.6	19 084	32.9	12 717	21.9
Sunday	1 909	3.3	23 594	40.5	20 282	34.8	12 482	21.4

* N = Number of hours.

Table 6.9: Per cent of time spent indoors with window open and closed, and outdoors by month.

Month	% time indoors w/closed window	% time indoors w/open window	% time outdoors
January	75.6	18.5	2.5
February	77.5	16.9	2.5
March	77.1	14.8	4.0
April	67.9	20.7	7.9
May	49.7	32.2	14.4
June	32.5	43.3	20.9

Table 6.10: Per cent of time spent indoors with window open and closed, and outdoors by population subgroup.

Season	% time indoors	% time indoors w/window open	% time outdoors
WINTER			
Population subgroups			
Randomly chosen adults	77.2	17.0	2.4
Children with lung disease	81.2	9.9	6.5
Adults with lung disease	72.7	21.2	2.6
SUMMER			
Population subgroups			
Randomly chosen adults	45.6	35.4	15.4
Children with lung disease	55.0	18.9	23.0
Adults with lung disease	41.6	37.3	17.5

Table 6.11: Per cent of time spent indoors with window open and closed, and outdoors by sex.

Season	Indoors/outdoors			
	Travelling	Indoors	Indoors w/window open	Outdoors
WINTER				
Population subgroups				
Randomly chosen adults				
Sex				
Women	3.1%	77.4%	18.3%	1.1%
Men	3.6%	76.9%	15.6%	3.9%
Children with lung disease				
Sex				
Girls	1.9%	89.5%	4.7%	3.9%
Boys	2.8%	75.7%	13.4%	8.2%
Adults with lung disease				
Sex				
Women	3.6%	70.9%	24.2%	1.3%
Men	3.4%	74.0%	19.0%	3.6%
SUMMER				
Population subgroups				
Randomly chosen adults				
Sex				
Women	3.6%	47.1%	36.6%	12.7%
Men	3.6%	43.5%	34.6%	18.3%
Children with lung disease				
Sex				
Women	3.2%	59.4%	21.2%	16.2%
Men	3.1%	52.5%	17.7%	26.7%
Adults with lung disease				
Sex				
Women	3.4%	35.8%	46.6%	14.1%
Men	3.6%	45.8%	30.8%	19.8%

Tables 6.12 to 6.15 show per cent of time spent sleeping, awake doing normal daily activities or doing hard work or exercising heavily, by weekday, month, population subgroup and sex. Norwegians sleep more in winter (35% of the time) than in summer (33.5%), whereas they exercise heavily only slightly more in the summer. They sleep more on Sundays. Children sleep more than adults, women sleep more than men. Table 6.16 shows at what hour people go to sleep or wake up in winter and summer. These figures possibly include napping or shift work, therefore one individual may wake up or go to sleep more than once per day.

Table 6.12: Per cent of time spent sleeping, awake with normal activities and exercising heavily, by weekday.

Season	% time sleeping	% time daily activities	% time hard work/ heavy exercise
WINTER			
<u>Weekday</u>			
Monday	34.2	64.4	1.4
Tuesday	34.0	64.4	1.5
Wednesday	34.1	64.5	1.4
Thursday	34.0	64.6	1.4
Friday	33.0	65.7	1.3
Saturday	36.1	62.4	1.5
Sunday	39.0	59.3	1.7
SUMMER			
<u>Weekday</u>			
Monday	33.3	65.0	1.7
Tuesday	32.7	65.7	1.6
Wednesday	32.5	65.9	1.6
Thursday	32.8	65.7	1.5
Friday	32.1	66.6	1.4
Saturday	34.8	63.5	1.7
Sunday	37.1	61.8	1.1

Table 6.13: Per cent of time spent sleeping, awake with normal activities and exercising heavily, by month.

Month	% time sleeping	% time daily activities	% time hard work/ heavy exercise
January	35.3	63.1	1.6
February	34.7	64.1	1.3
March	34.7	63.5	1.7
April	33.5	64.9	1.7
May	34.1	64.3	1.6
June	32.8	65.8	1.4

Table 6.14: Per cent of time spent sleeping, awake with normal activities or exercising heavily, by population subgroups.

Season	% time sleeping	% time daily activities	% time hard work/ heavy exercise
WINTER			
Population subgroups			
Randomly chosen adults	34.7	63.9	1.4
Children with lung disease	42.4	54.8	2.8
Adults with lung disease	34.1	64.8	1.1
SUMMER			
Population subgroups			
Randomly chosen adults	33.3	65.2	1.5
Children with lung disease	40.5	57.8	1.6
Adults with lung disease	32.9	65.6	1.5

Table 6.15: Per cent of time men, women and children spend sleeping, awake with normal activities or exercising heavily.

Season	Activity level		
	Sleeping	Daily activities	Hard work/ exercise
WINTER			
Population subgroups			
Randomly chosen adults			
Sex			
Women	35.3%	63.4%	1.3%
Men	34.0%	64.4%	1.6%
Children with lung disease			
Sex			
Girls	41.5%	56.1%	2.4%
Boys	43.1%	53.9%	3.0%
Adults with lung disease			
Sex			
Women	35.2%	63.8%	1.1%
Men	33.3%	65.5%	1.1%
SUMMER			
Population subgroups			
Randomly chosen adults			
Sex			
Women	33.9%	65.1%	1.0%
Men	32.8%	65.2%	2.1%
Children with lung disease			
Sex			
Women	38.6%	60.7%	.8%
Men	41.6%	56.2%	2.2%
Adults with lung disease			
Sex			
Women	33.7%	65.0%	1.3%
Men	32.4%	66.0%	1.6%

Table 6.16: Hour of awakening and going to sleep in winter and summer in children and adults.

	Season					
	Winter			Summer		
	Adult women	Adult men	Children	Adult women	Adult men	Children
	% particip.	% particip.	% particip.	% particip.	% particip.	% particip.
WAKE-UP						
1.00	.5%	.4%	.1%	.3%	.4%	
2.00	.1%	.1%	.1%	.1%	.0%	
3.00	.2%	.2%	.2%	.1%	.0%	
4.00	.4%	.3%	.1%	.2%	.1%	.1%
5.00	.3%	.3%	.1%	.3%	.2%	.1%
6.00	.9%	3.3%	.7%	.9%	4.2%	.1%
7.00	12.4%	25.7%	4.1%	15.1%	26.6%	2.2%
8.00	26.6%	28.6%	46.2%	29.3%	30.5%	39.7%
9.00	24.8%	17.7%	24.7%	27.0%	19.5%	32.2%
10.00	18.0%	11.8%	12.2%	14.9%	11.0%	15.1%
11.00	6.3%	4.0%	6.7%	5.0%	2.7%	5.6%
12.00	2.4%	1.5%	2.2%	1.7%	1.1%	2.3%
13.00	1.0%	1.0%	.9%	.9%	.6%	1.0%
14.00	.4%	.4%	.3%	.2%	.2%	.1%
15.00	.6%	.2%	.3%	.6%	.2%	
16.00	1.0%	.2%	.2%	.5%	.3%	.3%
17.00	.9%	1.1%		.3%	.7%	.4%
18.00	1.0%	1.0%	.2%	.6%	.8%	.1%
19.00	1.2%	1.3%	.5%	.9%	.7%	.5%
20.00	.4%	.7%		.4%	.3%	
21.00	.3%	.1%		.3%	.0%	
22.00	.2%	.1%		.3%	.0%	
23.00	.1%	.1%		.0%	.0%	
24.00	.0%	.1%				
GO TO SLEEP						
1.00	5.2%	3.7%	.5%	5.3%	3.8%	.1%
2.00	2.3%	2.0%	.6%	2.3%	1.4%	.8%
3.00	1.4%	.8%	.5%	1.1%	.8%	.1%
4.00	.6%	.4%	.2%	.5%	.3%	.5%
5.00	.4%	.3%	.3%	.3%	.2%	
6.00	.4%	.8%	.1%	.2%	.4%	.1%
7.00	.7%	.4%		.8%	.2%	
8.00	.7%	.3%	.1%	.9%	.1%	.3%
9.00	.2%	.3%	.2%	.2%	.1%	
10.00	.2%	.1%	.1%	.1%	.0%	
11.00	.2%	.1%	.2%	.0%	.1%	
12.00	.2%	.1%	.1%	.1%	.0%	.1%
13.00	.3%	.1%		.1%	.1%	.1%
14.00	.4%	.5%		.2%	.4%	.4%
15.00	1.0%	1.0%	.3%	.3%	.8%	.4%
16.00	1.0%	1.1%	.3%	.7%	.8%	.1%
17.00	1.1%	1.1%	.2%	.9%	.6%	.1%
18.00	.6%	.6%	.3%	.4%	.2%	.1%
19.00	.1%	.1%	.3%	.3%	.0%	.1%
20.00	.2%	.2%	13.1%	.2%	.1%	4.2%
21.00	1.4%	2.3%	37.0%	.6%	1.1%	30.8%
22.00	11.8%	16.7%	20.0%	7.1%	13.8%	23.5%
23.00	35.9%	38.8%	17.7%	34.6%	39.1%	23.8%
24.00	33.6%	28.2%	7.6%	42.8%	35.7%	14.2%

For the following calculations the basis is all registered hours that individuals said they woke up or went to sleep.

In winter, 15% of adult women were awake at 0700 or earlier as opposed to 30% of adult men; 41% adult women were awake at 0800 as opposed to 59% of men; 66% women have woken up by 0900 as opposed to 76% in men. In children, 5% wake up at 0700 or earlier; 52% have woken up by 0800 and 76% have woken up by 0900.

In summer the pattern is similar for adults, but they generally wake up earlier. Children wake up later in summer.

For going to sleep, a reference time of 1900 was chosen. In winter, 14% of women have gone to sleep by 2200 as opposed to 19% in men; 49% of women have gone to sleep by 2300 as opposed to 58% in men; by 2400 83% of women and 86% men have gone to sleep. In children, 13% have gone to sleep by 2000, 50% have gone to sleep by 2100, and 70% by 2200.

In summer, all groups go to sleep later, but for children the difference is larger.

People in general did not travel at all 22% of the study days. 50% of the days they travelled less than 30 minutes. On 75% of study days they travelled less than 1 hour. Tables 6.17 to 6.20 show the number of minutes spent travelling per day in little, medium or heavy traffic by weekday, month, population group and sex. Essentially people spend the same amount of time in traffic winter and summer, and the same amount of time in each of the three categories little, medium or heavy traffic. Generally, people in Grenland spend 5 to 10 minutes per day in heavy traffic, and 20 to 30 minutes in little or average traffic. These numbers are not substantially different between all three study groups. Adult women travel less than men, but this difference is evenly spread in all three categories.

Table 6.17: Number of minutes per day spent travelling in little, medium or heavy traffic by weekday.

Season	Travelling in heavy traffic (minutes)	medium traffic (minutes)	little traffic (minutes)	Total daily travelling
WINTER				
Weekday				
Monday	5.6	22.4	20.4	48.4
Tuesday	5.3	24.3	19.6	49.2
Wednesday	5.2	25.5	20.6	51.3
Thursday	6.2	24.7	19.4	50.3
Friday	6.7	27.1	22.0	55.8
Saturday	5.2	20.6	24.5	50.3
Sunday	3.8	17.1	38.9	59.8
SUMMER				
Weekday				
Monday	6.6	65.0	20.7	52.2
Tuesday	7.8	65.7	22.6	53.3
Wednesday	7.0	65.9	19.8	51.7
Thursday	6.9	65.7	20.6	53.0
Friday	8.8	66.6	19.8	52.8
Saturday	5.3	63.5	20.3	46.1
Sunday	6.4	61.8	28.7	58.7

Table 6.18: Number of minutes per day spent travelling in little, medium or heavy traffic by month.

Month	Travelling in heavy traffic (minutes)	medium traffic (minutes)	little traffic (minutes)	Total daily travelling
January	5.4	22.2	23.7	51.4
February	5.1	23.5	22.8	51.4
March	7.4	24.5	28.4	60.4
April	6.5	22.9	19.8	49.2
May	7.3	23.3	22.7	53.3
June	6.7	24.8	20.9	52.4

Table 6.19: Number of minutes per day spent travelling in little, medium or heavy traffic by population subgroups.

	Travelling in heavy traffic (minutes)	Travelling in medium traffic (minutes)	Travelling in little traffic (minutes)	Total daily travelling
<u>Population subgroups</u>				
Randomly chosen adults	6.1	23.4	23.2	52.7
Children with lung disease	6.5	18.0	19.1	43.7
Adults with lung disease	6.5	25.2	21.3	53.1

Table 6.20: Number of minutes spent travelling in little, medium or heavy traffic by sex.

	Heavy traffic	Medium traffic	Light traffic	Total daily travelling
<u>Population subgroups</u>				
Randomly chosen adults				
Sex				
Women	4.73	19.50	21.80	46.04
Men	7.61	27.74	24.81	60.15
Children with lung disease				
Sex				
Girls	6.59	24.93	19.82	51.35
Boys	6.49	13.78	18.70	38.98
Adults with lung disease				
Sex				
Women	6.34	21.75	16.17	44.26
Men	6.64	27.80	25.16	59.61

People in general did not shop at all 72% of study days. 80% of days they shopped less than 30 minutes, and they shopped an hour or more only 13% of days. Tables 6.21 to 6.24 show the number of minutes spent shopping in Skien, Porsgrunn, or other places by weekday, month, population group and sex. It must be emphasized here that these figures may have changed since 1988 because of increased opening hours for many stores. People spent more time shopping in Skien than in Porsgrunn or other places and they shopped mostly on Thursdays, Fridays and Saturdays. They spent slightly more time shopping in summer than in winter. Children spent far less time shopping in Skien and Porsgrunn (7%-8% as opposed to 14%) than adults but the same amount of time other places. Women spent more time shopping than men and spent more time shopping in Skien and Porsgrunn than men, whereas men spent more time than women shopping other places.

Table 6.21: Number of minutes per day spent shopping in Skien, in Porsgrunn and other places by season and week-day.

Season	Shopping in Skien (minutes)	in Porsgrunn (minutes)	other places (minutes)	Total shopping (minutes)
WINTER				
Weekday				
Monday	10.3	7.4	2.5	20.2
Tuesday	9.9	7.9	3.3	21.1
Wednesday	11.5	9.0	3.2	23.7
Thursday	14.8	11.5	3.4	29.7
Friday	13.0	11.9	3.4	28.3
Saturday	18.6	16.8	5.4	40.9
Sunday	2.3	1.9	3.1	7.3
SUMMER				
Weekday				
Monday	8.9	7.5	2.2	18.6
Tuesday	14.5	9.6	3.4	27.5
Wednesday	10.0	8.9	2.8	21.7
Thursday	16.7	12.3	3.5	32.5
Friday	13.7	10.7	3.3	27.7
Saturday	16.3	15.2	4.4	36.0
Sunday	2.6	1.5	3.1	7.2

Table 6.22: Number of minutes per day spent shopping in Skien, in Porsgrunn and other places by month.

Month	Shopping in Skien (minutes)	in Porsgrunn (minutes)	other places (minutes)	Total shopping (minutes)
January	12.4	11.2	3.2	26.8
February	11.3	8.6	3.2	23.1
March	8.2	6.5	6.5	21.3
April	14.6	10.6	2.8	28.0
May	11.7	9.7	3.2	24.6
June	11.3	8.6	3.4	23.4

Table 6.23: Number of minutes per day spent shopping in Skien, in Porsgrunn and other places by population sub-groups.

	Shopping in Skien (minutes)	in Porsgrunn (minutes)	other places (minutes)	Total daily shopping
Population subgroups				
Randomly chosen adults	11.5	9.8	3.5	24.9
Children with lung disease	7.0	7.9	3.8	18.7
Adults with lung disease	13.7	8.0	2.4	24.0

Table 6.24: Number of minutes per day spent shopping in Skien, in Porsgrunn and other places by sex.

Season	Shopping in Skien	Shopping in Porsgrunn	Shopping other	Total daily shopping
WINTER				
Sex				
Women	12.78	10.39	2.76	25.93
Men	10.16	8.50	4.20	22.86
SUMMER				
Sex				
Women	14.51	9.84	2.75	27.11
Men	9.11	8.98	3.75	21.84

For all people in this study, 69% of registered days no cigarettes were smoked, 19% of days 1-10 cigarettes were smoked, whereas more than 20 cigarettes were smoked only 2% of the days. The maximum number of cigarettes smoked in one day was reported to be 49. Tables 6.25 to 6.27 show number of cigarettes smoked, % time spent smoking and % time exposed to passive smoking in smokers and non-smokers. Generally smokers smoke the same amounts winter and summer and the same amount of time goes to smoking in both seasons. Individuals seem to be slightly less exposed to other people's tobacco smoking in the summer. Women smoke fewer cigarettes than men and are exposed to other people's tobacco smoking more than men. However, more women than expected smoke, especially in the group 30-40 years (see Table 6.28).

Table 6.25: Number of cigarettes smoked, per cent time spent smoking and time exposed for smoking by season and weekday.

Season	Smoking (mean number)	Hours spent smoking (mean)	Cigarettes smoked per hour (mean)	Hours exposed to passive smoking (mean)
WINTER				
Weekday				
Monday	9.93	3.17	1.24	4.80
Tuesday	9.77	3.10	1.23	4.79
Wednesday	9.92	3.11	1.23	4.60
Thursday	9.76	3.16	1.24	4.65
Friday	10.26	3.31	1.27	5.02
Saturday	10.08	3.51	1.30	5.94
Sunday	9.30	3.27	1.25	5.73
SUMMER				
Weekday				
Monday	9.96	3.59	1.25	4.54
Tuesday	10.00	3.59	1.22	4.46
Wednesday	10.07	3.51	1.24	4.32
Thursday	10.09	3.59	1.21	4.49
Friday	10.56	3.84	1.23	4.71
Saturday	10.13	3.57	1.24	4.54
Sunday	9.49	3.36	1.20	4.63

Table 6.26: Mean number of cigarettes per day (where at least one cigarette was smoked), mean number of hours with at least one cigarette smoked, and mean number of passive smoking hours (all subjects included), per month.

Month	Persons smoked	Total cigarettes	Hours smoked	Cigarettes per hour	Hours passive smoking	
	Days	Mean	Mean	Mean	Mean per day	Days
January	1325	9.58	3.11	1.28	5.01	2049
February	1519	10.00	3.27	1.23	5.10	2195
March	299	10.42	3.67	1.28	5.14	328
April	293	10.35	3.68	1.32	4.44	437
May	1245	9.94	3.54	1.21	4.64	1567
June	857	10.12	3.62	1.22	4.37	966

Table 6.27: Mean number of cigarettes per day and week (where at least one cigarette was smoked), mean number of hours with at least one cigarette smoked, and mean number of passive smoking hours (all adult subjects included), per season, population group and sex.

Season	Persons smoked	Total cigarettes	Hours smoked	Cigarettes per hour	Indiv. sum cig./week		Hours passive smoking	
	Days	Mean	Mean	Mean	Mean	Person-weeks	Mean per day	Days
WINTER								
Population subgroups								
Randomly chosen adults								
Sex								
Women	1772	9.96	2.88	1.25	61.6	605	5.29	1974
Men	1187	11.09	3.99	1.32	67.5	437	4.64	1655
Adults with lung disease								
Sex								
Women	118	5.10	1.98	1.14	29.2	72	5.88	395
Men	60	6.64	1.40	1.03	40.5	83	4.70	405
SUMMER								
Population subgroups								
Randomly chosen adults								
Sex								
Women	1297	9.55	2.91	1.21	58.4	500	4.60	1323
Men	998	11.87	4.58	1.30	71.3	368	4.21	980
Adults with lung disease								
Sex								
Women	75	6.88	2.81	1.14	40.5	54	4.99	283
Men	24	7.11	1.42	1.01	43.7	77	4.99	330

Table 6.28: Mean number of cigarettes smoked per day for adult smokers by sex and age group.

Age group	Sex					
	Women			Men		
	Mean No. cigarettes	No. of days	No. of smokers*	Mean No. cigarettes	No. of days	No. of smokers*
20-29	9.6	1081	16	5.9	302	6
30-39	9.2	2760	34	12.4	871	18
40-49	10.3	1289	17	12.6	1402	21
50-59	9.5	1030	11	11.5	1239	18
60-69	8.6	551	10	8.2	1291	13
70-79	1.7	39		4.1	103	

* Smokers = people who smoked at least once.

Number of individuals reporting per day during the study periods January-March and April-June varies, since not all individuals started filling the diary on the same date. However, almost 100 per cent participants reported in periods mid January-end of February and beginning og May-first week of June.

Even though most of these findings are not surprising, it is rather unusual to be able to quantify so exactly time spent in different micro-environments as was possible in this study.

7 DESCRIPTION OF ESTIMATED EXPOSURE TO DIFFERENT AIR POLLUTION COMPONENTS

Most previous studies of the effects of air pollution have used air pollutant measurements made at one to several outdoor stations as surrogates for individual air pollution exposure. In addition, most have used 24-hour averages of these pollutants. However, as explained in Chapter 3, it was felt that collecting information on an hour by hour basis facilitated determining the relative effect of each component.

Based on information reported in the diary, each participant's exposure to each component was estimated using the various algorithms described in earlier sections. These calculations resulted in hour for hour information for O_3, SO_2, NO_2, NO, CO, Cl_x, suspended particles (fine fraction), nitrates, and sulfates. For Cl_x (chlorine), the exposure is not derived from the measured Cl (chloride), but is representative for a plume from an industrial source. This information can be graphically presented as in Figure 7.1 for one individual and for the month of February. The total amount of subjective complaints is shown at the end of the figure.

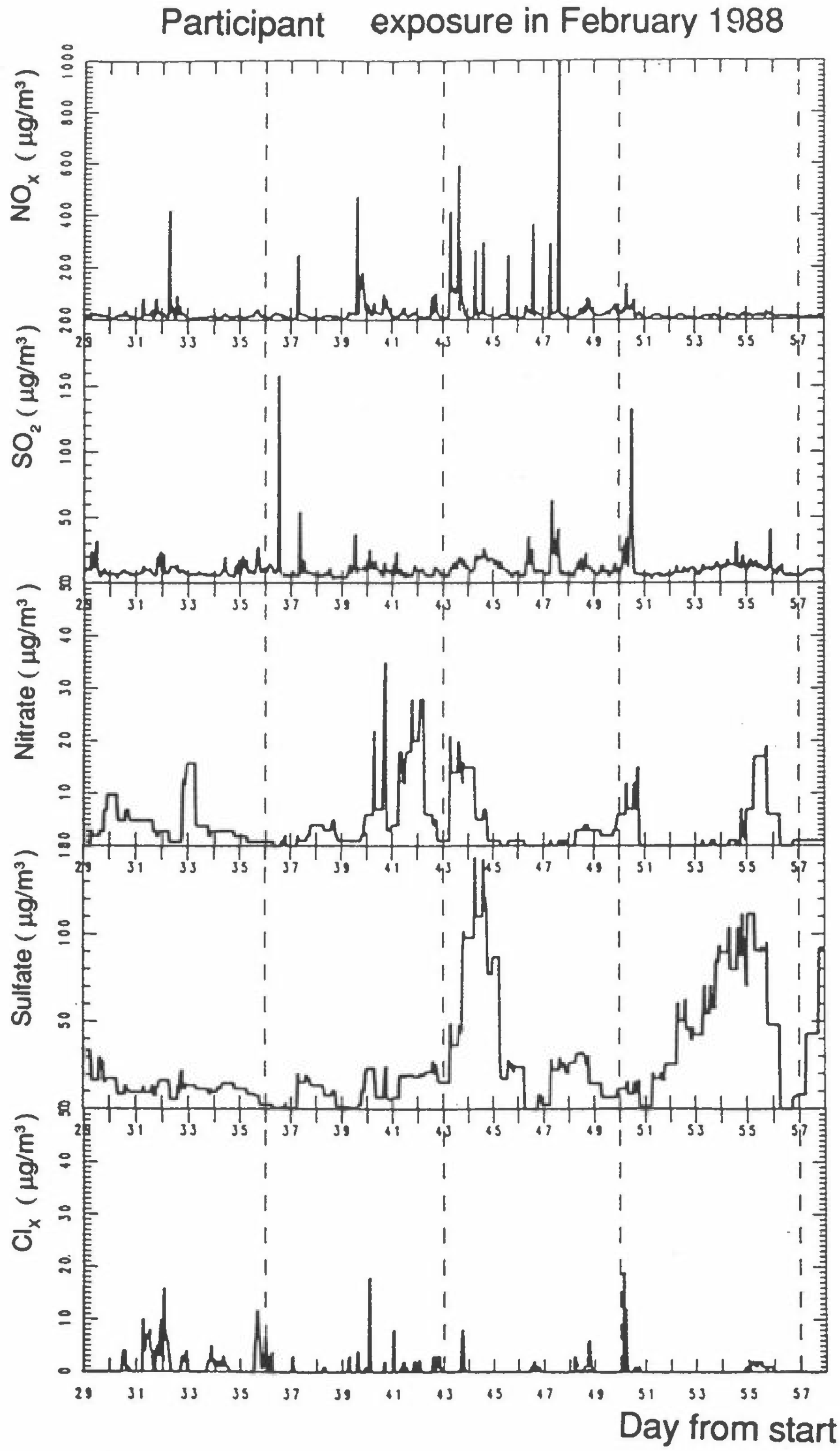


Figure 7.1: Continuous estimated exposure for one participant during the month of February for a set of air pollutants. Total number of health complaints is given at the end.

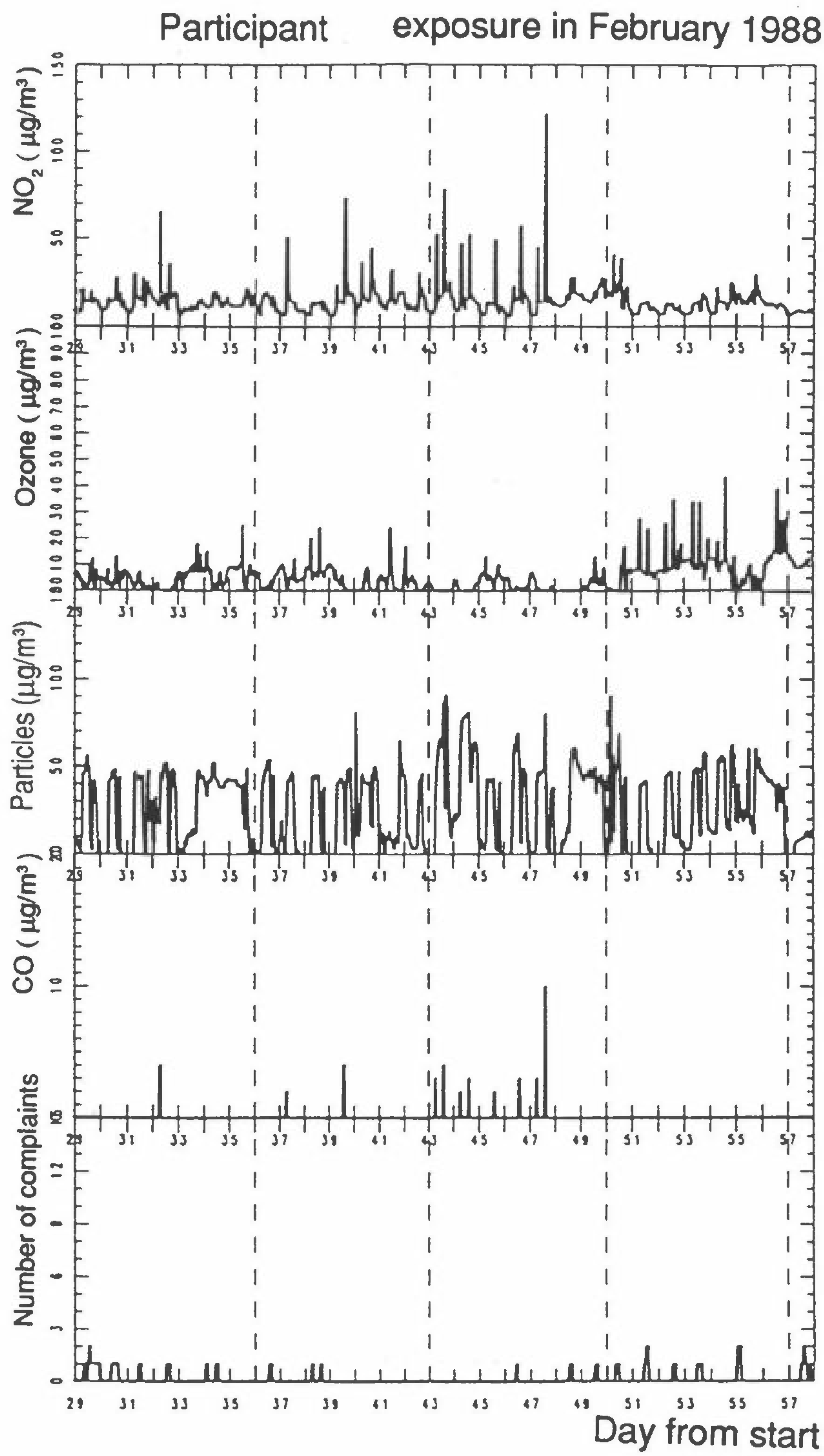


Figure 7.1, cont.

The aim of this investigation is to correlate reporting of each symptom in all individuals with air pollution exposure. It is therefore of interest to see how the exposure estimates for each pollutant correlate with each other (it was thought before the investigation began that this study should be able to distinguish between components), and vary geographically, by season, time of day, and micro-environment.

7.1 STATISTICAL PROPERTIES OF THE EXPOSURE ESTIMATES AND THEIR POSSIBLE INTERDEPENDENCE

Exposure estimates for each component are generally more interrelated in summer than in winter, but often of the same general dimensions. Important exceptions are relative humidity and sulfates (slight negative correlation in the winter, yet a stronger positive correlation in the summer); O_3 shows negative correlations with all compounds other than sulfates in the winter, whereas it is positively correlated with all compounds other than CO and Cl_x in the summer.

The Pearson correlation coefficients of log-transformed pollutant data (weighted by each individual's number of registered hours) are indicated in Table 7.1. Further tables comparing transformed and untransformed data (weighted and unweighted) are in Appendix 2. The calculations are based on individual's correlation coefficients.

Another method of examining air pollution interactions is by categorizing air pollutants as a function of presumed health effects. We chose to use suggested air quality guidelines (AQG) where available. The pollutant concentrations were divided into three categories:

Table 7.1: Weighted Pearson correlation coefficients for the log-transformed air pollution data for winter and summer.

			SUMMER										
			SO_2	NO_x	NO_2	O_3	Part-f	Cl_x	SO_4	NO_3	CO	$Temp._{out}$	RH_{out}
WINTER	SO_2	mean		0.78	0.79	0.24	0.62	0.19	0.44	0.38	-0.02	-0.12	0.08
		min		0.38	0.37	-0.53	0.01	-0.83	-0.03	0.01	-1.0	-0.47	-0.40
		max		0.99	0.99	0.99	0.97	0.76	0.97	0.95	1.0	0.57	0.49
	NO_x	mean	0.67		0.99	0.28	0.71	0.14	0.53	0.43	0.91	-0.12	0.15
		min	0.13		0.92	-0.60	0.20	-0.28	0.06	0.13	0.23	-0.51	-0.15
		max	0.98		1.0	0.98	0.98	0.48	0.97	0.95	1.0	0.57	0.51
	NO_2	mean	0.67	0.89		0.31	0.71	0.14	0.53	0.43	0.73	-0.13	0.18
		min	0.05	0.57		-0.57	0.18	-0.23	0.03	0.09	-1.0	-0.53	-0.14
		max	0.98	0.99		0.97	0.98	0.46	0.96	0.94	1.0	0.59	0.61
	O_3	mean	-0.09	-0.22	-0.10		0.35	-0.06	0.31	0.08	-0.35	0.43	-0.40
		min	-0.59	-0.71	-0.64		-0.58	-0.46	-0.21	-0.33	-1.0	-0.44	-0.68
		max	0.72	0.48	0.77		0.95	0.44	0.98	0.97	1.0	0.69	-0.04
	Part-f	mean	0.58	0.57	0.56	-0.09		0.29	0.60	0.45	0.60	0.09	0.15
		min	0.01	-0.09	-0.16	-0.55		-0.29	0.06	0.12	-1.0	-0.50	-0.26
		max	0.97	0.96	0.97	0.69		0.74	0.97	0.96	1.0	0.75	0.77
	Cl_x	mean	0.18	0.15	0.13	-0.03	0.23		0.08	0.05	-0.18	-0.06	0.15
		min	-0.24	-0.28	-0.28	-0.36	-0.31		-0.26	-0.52	-1.0	-0.44	-0.24
		max	0.60	0.60	0.40	0.45	0.64		0.60	0.29	1.0	0.30	0.65
	SO_4	mean	0.44	0.35	0.37	0.12	0.35	0.08		0.62	0.04	0.03	0.33
		min	-0.07	-0.57	-0.08	-0.17	-0.18	-0.15		0.44	-1.0	-0.57	-0.52
		max	0.91	0.91	0.95	0.73	0.91	0.33		0.99	1.0	0.64	0.77
	NO_3	mean	0.20	0.40	0.35	-0.12	0.26	0.09	0.43		0.07	-0.14	0.21
		min	-0.34	0.02	-0.14	-0.31	-0.18	-0.26	0.18		-1.0	-0.50	-0.42
		max	0.77	0.83	0.82	0.56	0.79	0.44	0.83		1.0	0.61	0.70
	CO	mean	0.02	0.83	0.68	-0.24	0.47	-0.00	-0.04	-0.02		0.00	-0.02
		min	-1.0	-0.70	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0		-1.0	-1.0
		max	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0
	$Temp._{out}$	mean	-0.16	0.11	0.14	-0.13	-0.01	0.03	-0.18	0.33	-0.00		-0.53
		min	-0.36	-0.23	-0.23	-0.41	-0.34	-0.28	-0.39	0.00	-1.0		-0.89
		max	0.18	0.34	0.41	0.17	0.39	0.44	0.39	0.69	1.0		0.56
	RH_{out}	mean	0.01	0.23	0.18	-0.39	-0.01	0.09	-0.15	0.28	-0.01	0.26	
		min	-0.19	0.05	-0.05	-0.60	-0.26	-0.51	-0.32	0.03	-1.0	-0.01	
		max	0.37	0.44	0.48	-0.15	0.29	0.29	0.33	0.54	1.0	0.61	

- over AQG (category 2)
- between 30% of AQG and AQG (category 1)
- and under 30% of AQG (category 0).

A new variable was created for each hour that accounted for simultaneous occurrence for each compound by category.

Table 7.2 gives the values used as AQG. The frequency distribution of this new variable allows investigating the simultaneous occurrence of high concentrations of several compounds.

Table 7.2: Suggested ambient air quality guidelines and equivalents for use in exposure categorization.

Component	Averaging time	Concentration ($\mu g/m^3$)	Reference
SO_2	1 hour	350	WHO (1987)
NO_2	1 hour	200	SFT (1982)
O_3	1 hour	100	SFT (1982)
CO	1 hour	25 mg/m^3	SFT (1982)
Suspended particles* (PM_{10})	24 hours	70	WHO (1987)
Total Cl (Cl_x)	24 hours	7.5	Personal communication NILU/National Institute of Public Health
Cl_x, + SO_4+NO_3 (acid aerosols)	24 hours	20	Personal communication NILU/National Institute of Public Health

*60 $\mu g/m^3$ was used as a 1-hour guideline for fine fraction of suspended particles in categorizing based on guidelines.

The results for winter and summer separately are shown in Table 7.3 for those occurrences over 0.5%.

It was originally felt that because of the geographical setting of the air pollution sources in this area it would be possible to study the relative effects of the pollutants since they would vary independently of each other. Table 7.3 reinforces this concept. In Grenland, the geographical placement of the principal sources were, together with local meteorological situations, modelled over short-time periods (1 hour). The most important sources in the area are industrial and high pollution concentrations are only expected sporadically (problems in operation). It is evident that high exposure only occurs for one compound at a time.

Table 7.3: Per cent of occurrences of different classification of air pollutants. Classifications in parenthesis are based on hourly air quality guidelines (AQG), if nothing else indicated between 30 and 100%, and (2)= over AQG.

WINTER VALUES		
Composition of pollutant compounds	Number of registered hours	Per cent
All compounds at low levels	169 388	35.3
Acid aerosols	10 596	2.2
Cl_x	6 060	1.3
Cl_x + aero	7 547	1.6
Cl_x(2) + aero	3 595	.7
Pr-f*	85 875	17.9
Pr-f + aero	17 641	3.7
Pr-f + Clx	3 847	.8
Pr-f + Clx + aero	9 147	1.9
Pr-f + Clx(2) + aero	4 614	1.0
Pr-f + Clx(2) + aero(2)	2 204	.5
Pr-f(2)	57 786	12.0
Pr-f(2) + aero	8 781	1.8
Pr-f(2) + Clx	2 457	.5
Pr-f(2) + Clx + aero	4 853	1.0
Pr-f(2) + Clx(2) + aero	2 935	.6
Pr-f(2) + Clx(2) + aero(2)	2 853	.6
O_3	31 237	6.5
O_3 + aero	2 731	.6
O_3 + Pr-f + aero	2 737	.6
Missing	35 281	7.4
Total	479 928	100.0

SUMMER VALUES		
Composition of pollutant compounds	Number of registered hours	Per cent
All compounds at low levels	115 529	26.0
Acid aerosol	15 453	3.5
Pr-f	36 516	8.2
Pr-f + aero	22 936	5.2
Pr-f(2)	2 129	.5
Pr-f(2) + aero	3 578	.8
O_3	109 071	24.5
O_3 + aero	8 874	2.0
O_3 + Pr-f	9 036	2.0
O_3 + Pr-f + aero	13 936	3.1
O_3(2)	25 668	5.8
O_3(2) + aero	2 825	.6
O_3(2) + Pr-f + aero	3 976	.9
Missing	61 384	13.8
Total	444 960	100.0

*Pr-f = suspended particles - fine fraction

The results (partially presented in Tables 7.1 and 7.3) seem to indicate that the individual compounds vary independently of each other. Variations in lifestyle (time spent outdoors, keeping windows open) etc. were large enough between seasons and population groups to indicate that these factors should be accounted for when investigating the effects of air pollution on health.

7.2 GEOGRAPHICAL DISTRIBUTION OF EXPOSURE ESTIMATES

The tables showing the distribution within the study area of the pollution estimates are assembled in Appendix 3. These tables indicate averages over all hours any individual was in a particular square kilometer. These tables must be interpreted with caution. They mostly reflect differences between areas where people are mainly indoors or outdoors, and at different times of day (work place as opposed to residence), or season of the year that individuals are in areas, number of individuals in an area etc.

One does see a general trend that highest pollution exposure is around the industrial zones, but there are exceptions also, that are primarily due to too small sample size in a specific square kilometer. Comparing means and medians is of value. During the study we observed only a few high pollution situations. This results in a rather stable and low median. The mean reflects to a greater degree the magnitude of the maximum values and how often they happened. Health effects if any, would not be evident before pollution attains the relatively seldom higher concentrations. Therefore, it is felt that the mean is a better indicator of the general pollution situation when comparing for example geographical areas.

7.3 VARIATIONS IN POLLUTION CONCENTRATIONS AS A FUNCTION OF DAY OF THE INVESTIGATION

This investigation began the second of January, 1988 and proceeded to the end of June. There was a break in the study between the middle of March and the middle of April.

Figure 7.2 shows the average temperature and relative humidity that the participants were exposed to during the investigation. Temperatures rose during the period, with considerable fluctuation during the winter months that were unusually mild. Figures 7.3 and 7.4 describe average gaseous and particulate air pollution concentrations by day of study. The two coldest periods that occurred that winter, were only accompanied by increases in sulfates and suspended particles. As reported earlier in 7.1, the individual pollution components seem rather independent of each other. There does not appear to be any clear trend.

The maximum concentrations are shown in Figures 7.5 to 7.7.

7.4 VARIATIONS IN POLLUTION AS A FUNCTION OF TIME OF DAY AND SEASON

Changes in temperature and humidity during day and night that are especially noticeable in the summer (Figure 7.8), affect some of the pollutants giving them marked 24-hour variations. Human activities that tend to occur at routine times during the day, e.g. driving to work, working, etc. also can affect exposure to pollutants.

Figure 7.9 and Table 7.4 show changes in exposure to the gaseous air pollutants as a function of season and time of day. NO and to a lesser degree NO_2 show the typical peaks associated with exposure to traffic pollution. These peaks are especially noticeable in the afternoon rush hour and are slightly higher during the winter than the summer. Exposure to NO is higher in

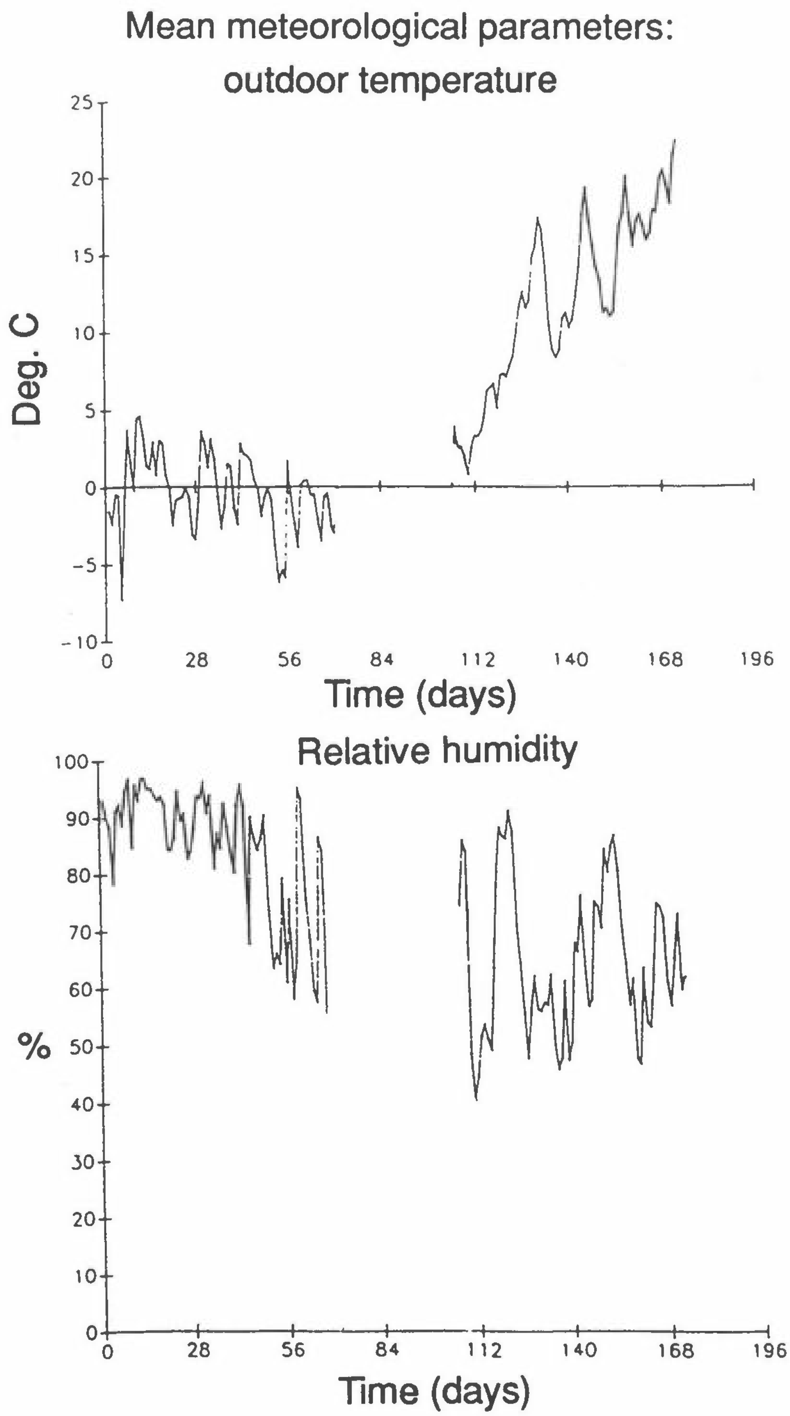


Figure 7.2: Daily averages of temperature and humidity per day during the investigation. Day 1= January 2, 1988.

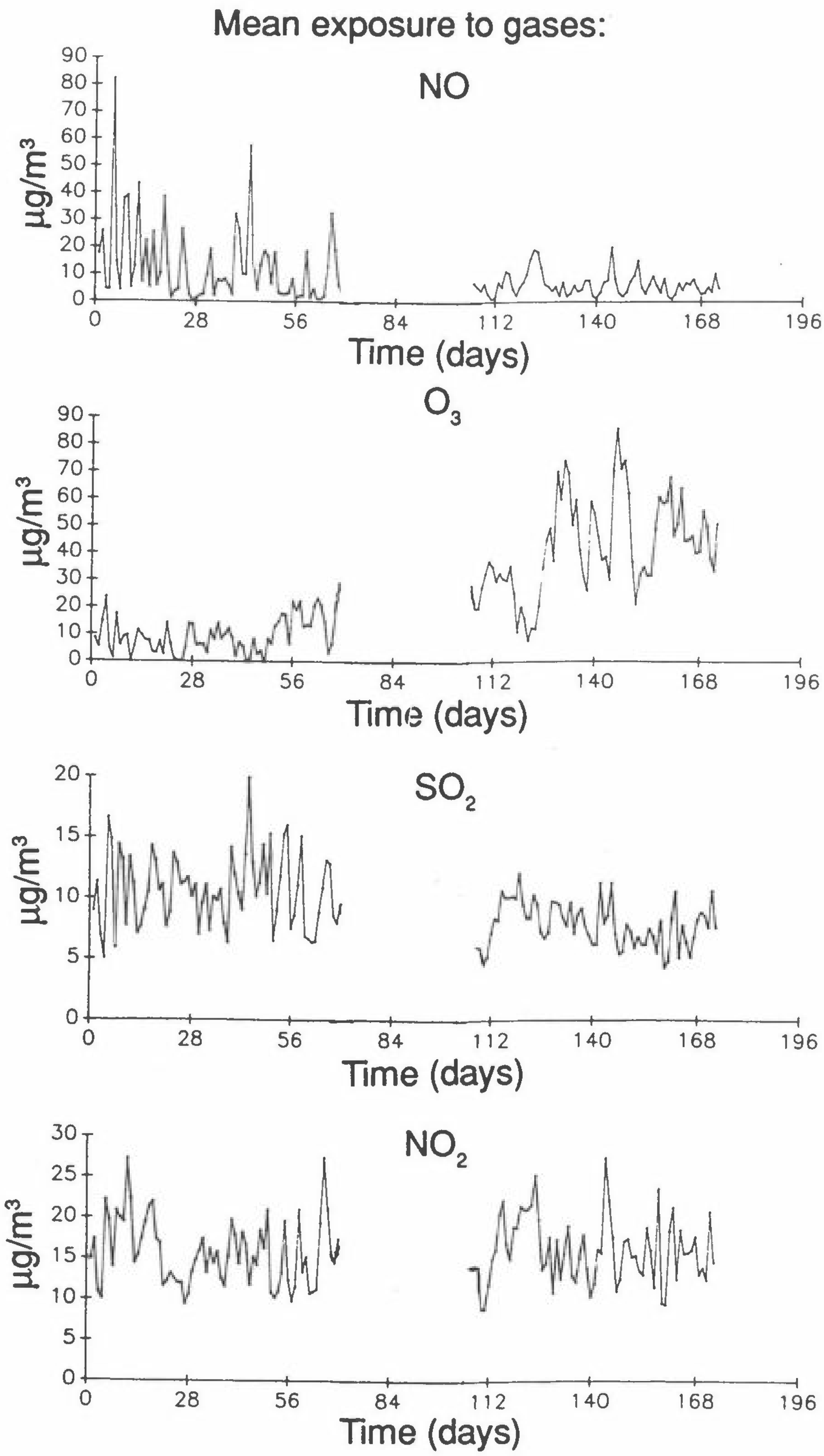


Figure 7.3: Mean daily concentrations of the exposure to gaseous pollutants NO, NO_2, O_3 and SO_2 as a function of day of study. Day 1 = January 2, 1988.

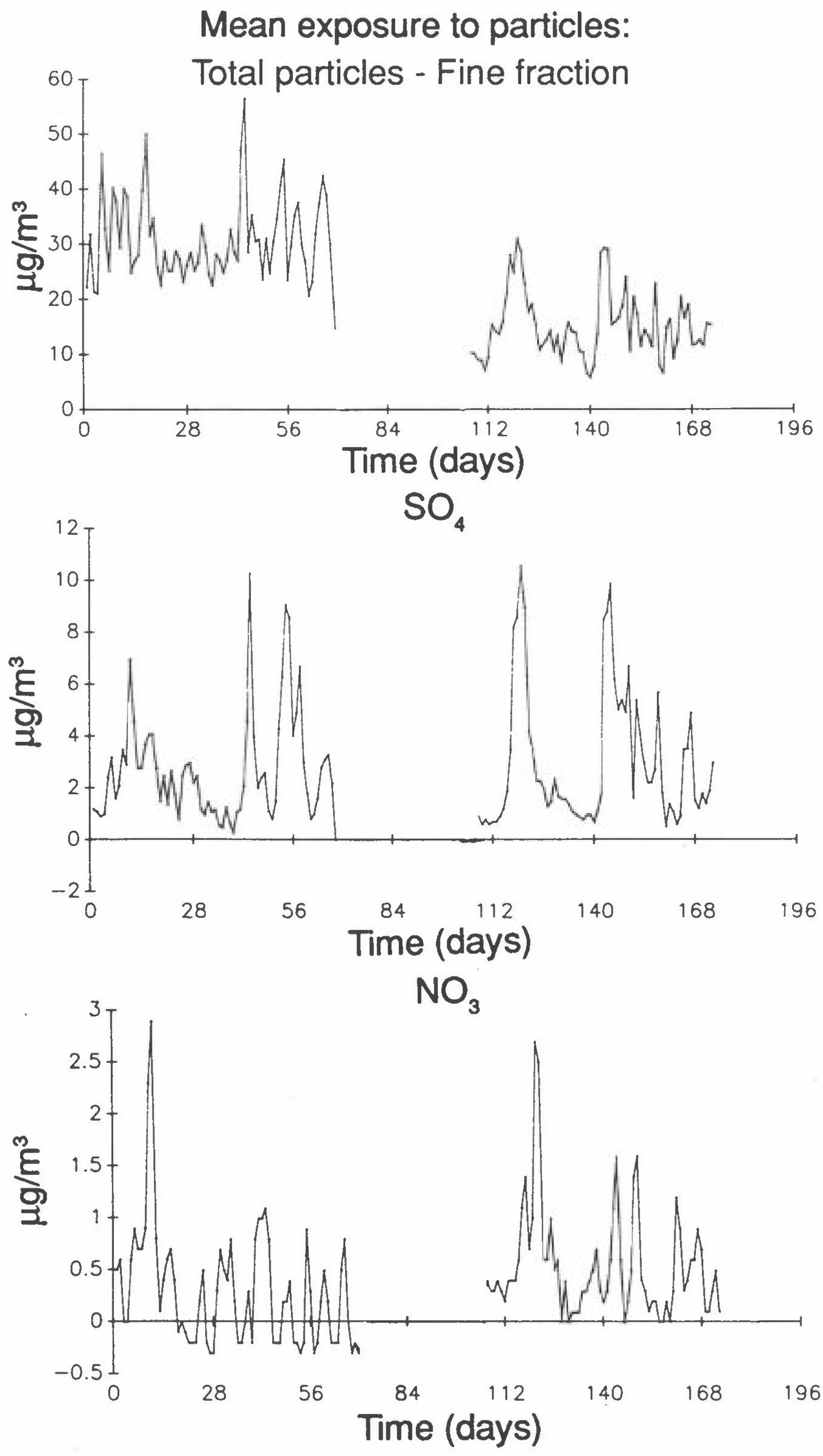


Figure 7.4: Mean daily exposure to the particulate pollutants, suspended particles (fine fraction), nitrates and sulfates per day. Day 1 = January 2, 1988.

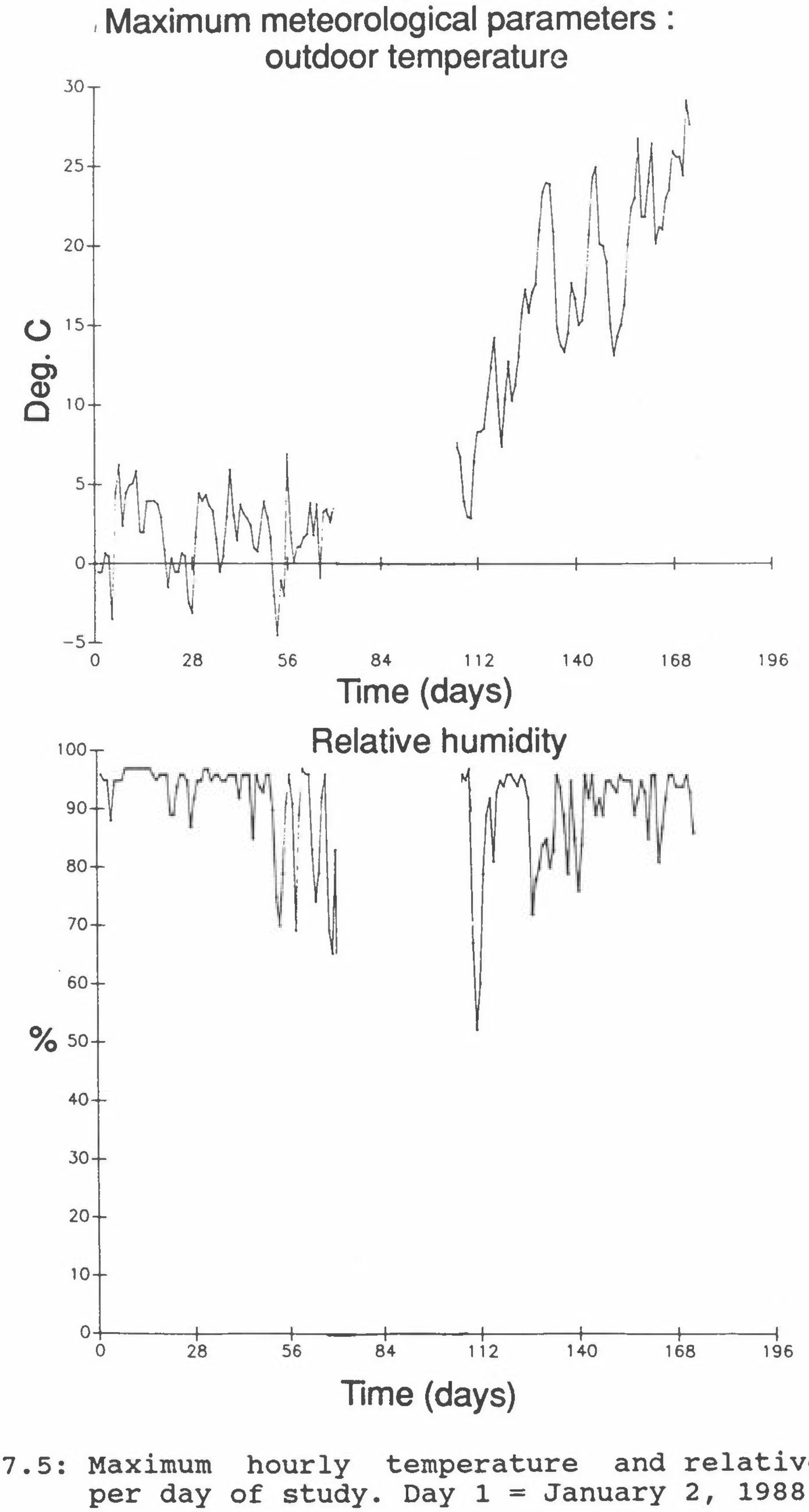


Figure 7.5: Maximum hourly temperature and relative humidity per day of study. Day 1 = January 2, 1988.

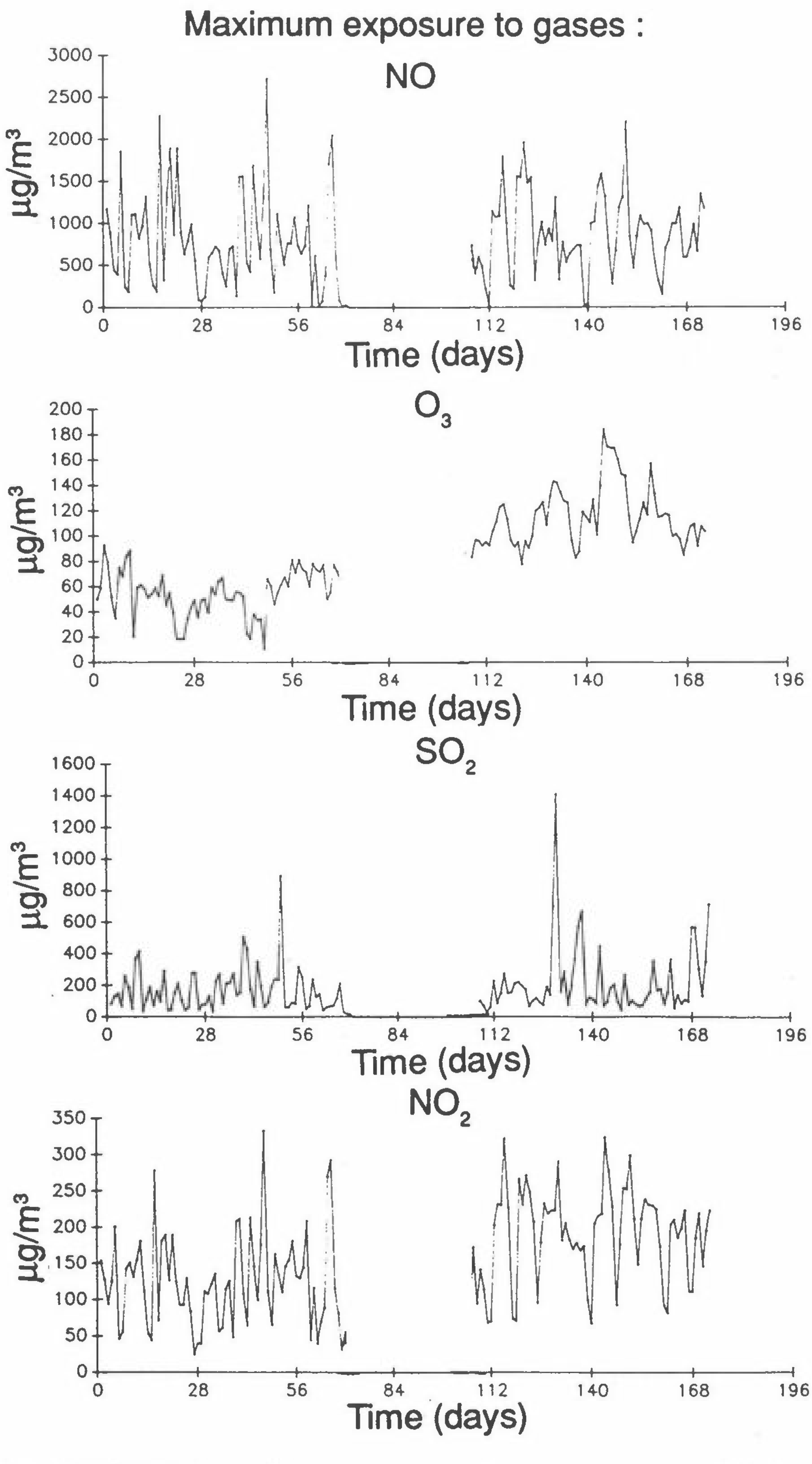


Figure 7.6: Maximum hourly exposure to gaseous pollutants, NO, NO_2, O_3 and SO_2 per day of study. Day 1 = January 2, 1988.

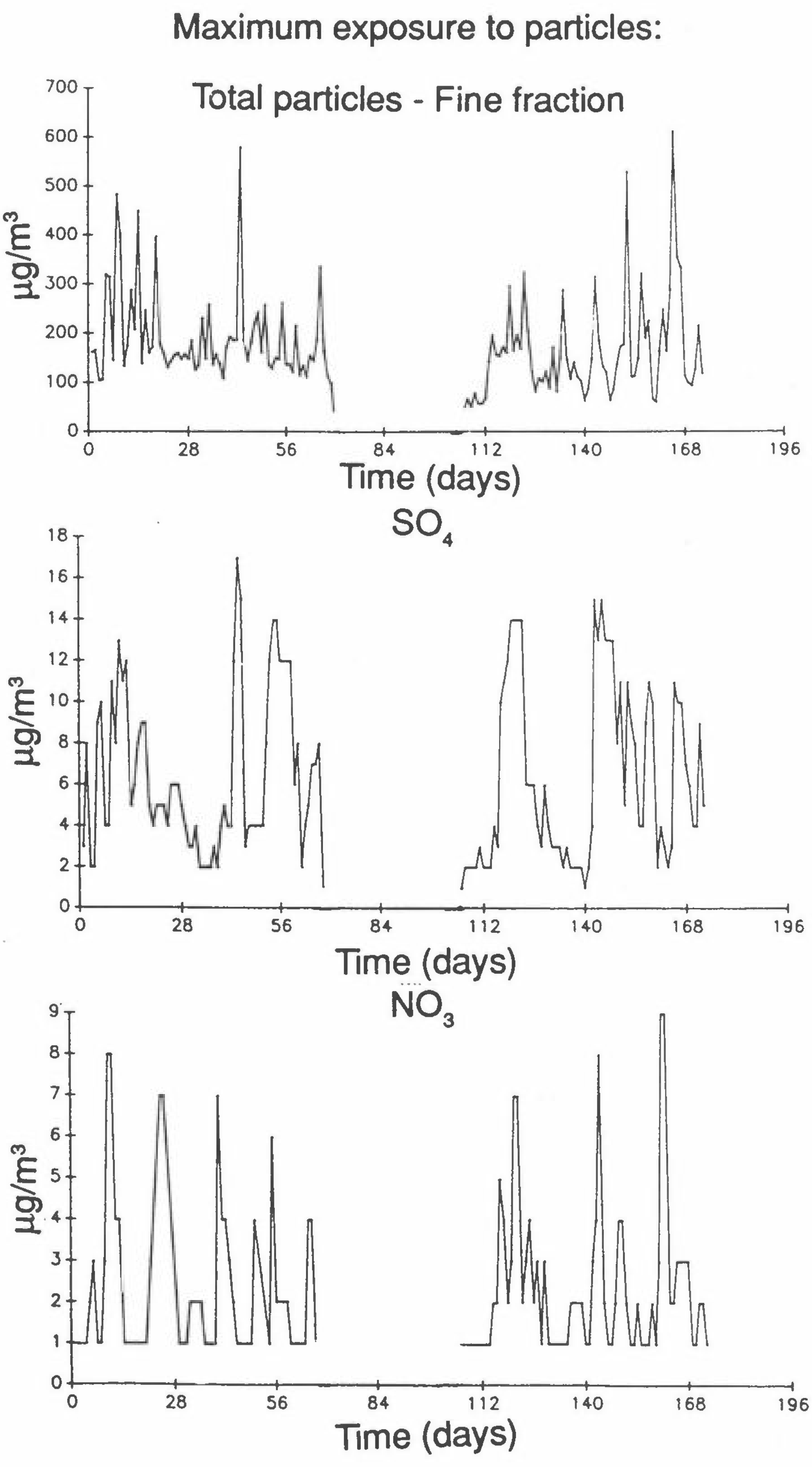


Figure 7.7: Maximum hourly exposure to particulate pollutants, suspended particles (fine fraction), nitrates and sulfates per day of study. Day 1 = January 2, 1988.

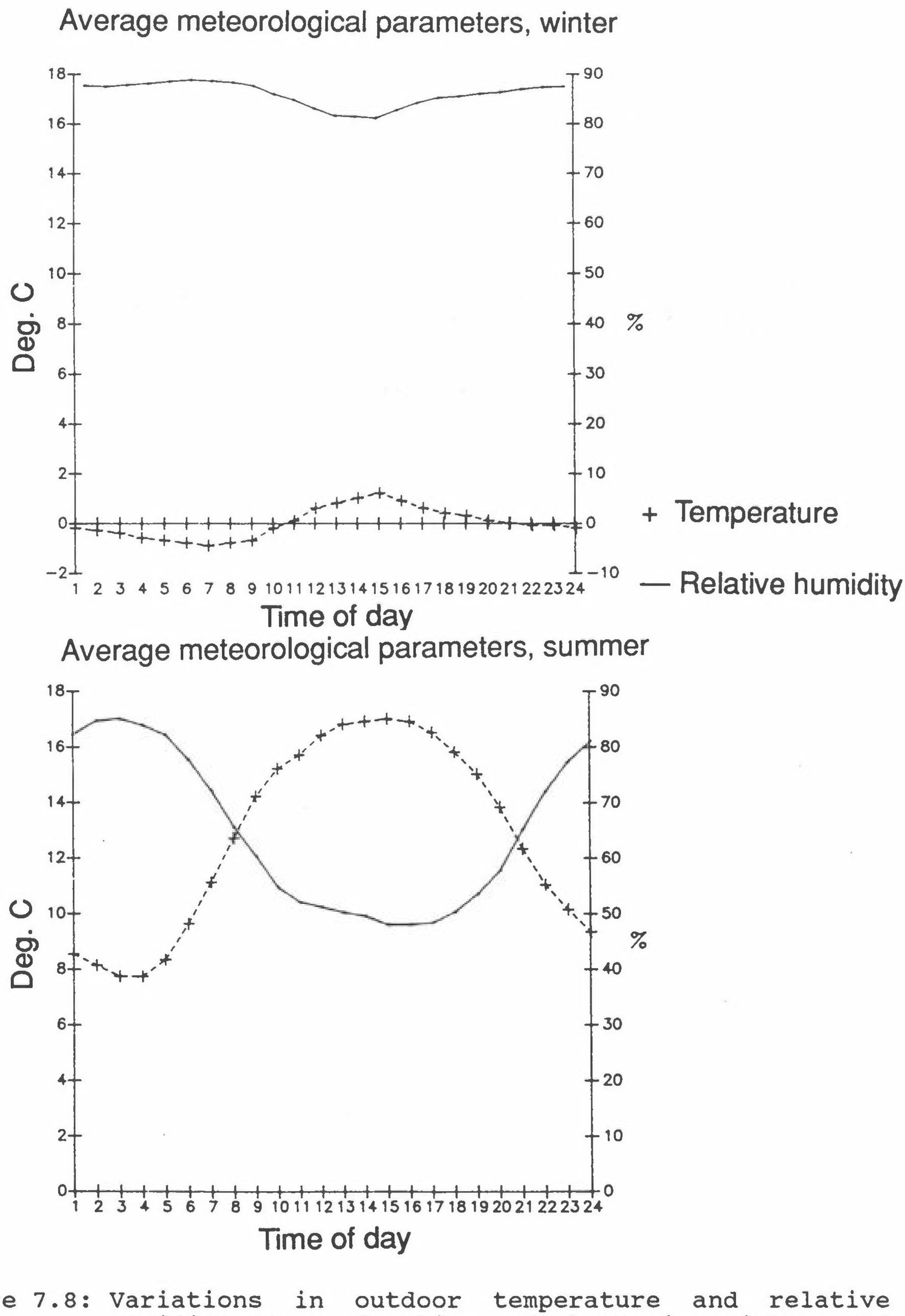
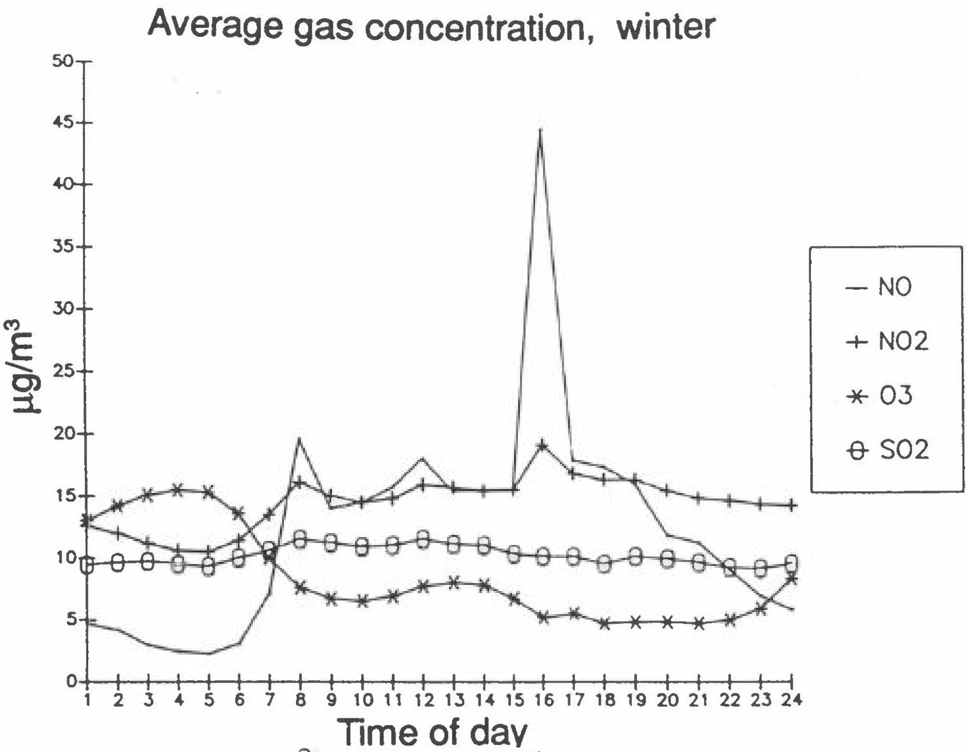


Figure 7.8: Variations in outdoor temperature and relative humidity as a function of hour in winter and summer.



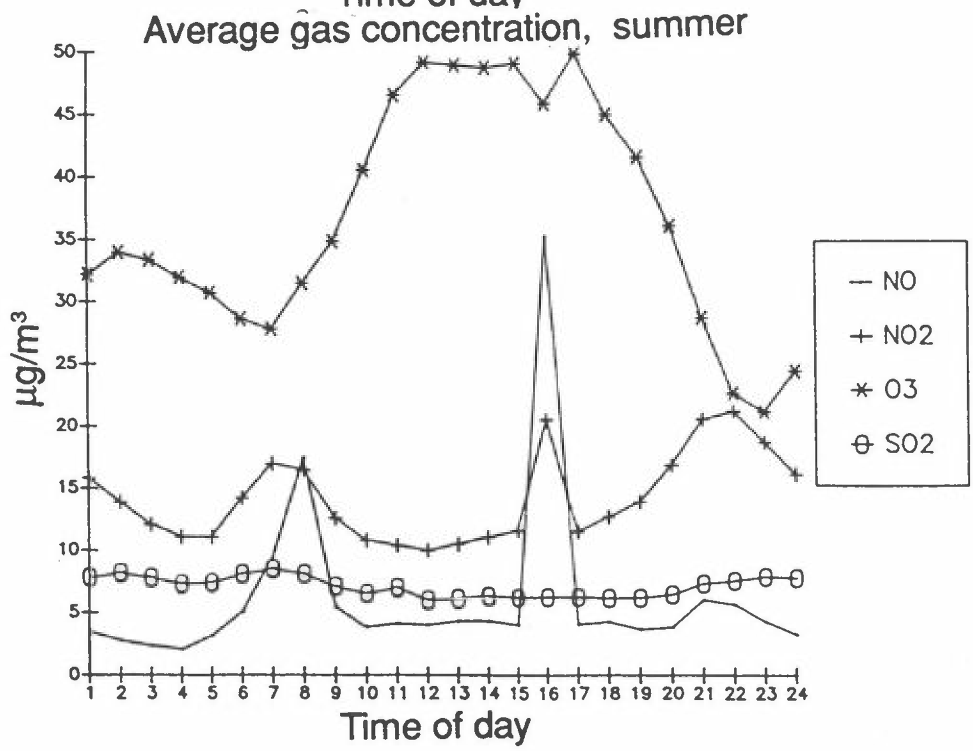


Figure 7.9: Variations in concentration of exposure to the gaseous pollutants, NO, NO_2, O_3 and SO_2 as a function of time of day and season.

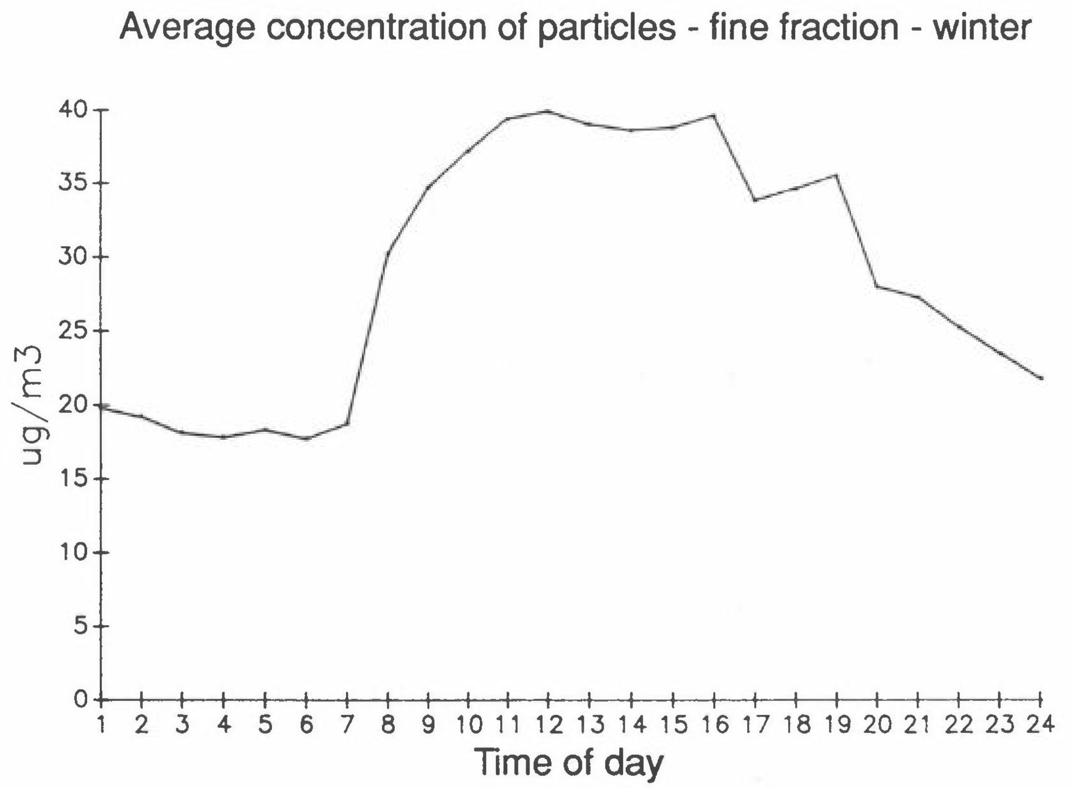
the winter than in the summer and exposure to NO_2 slightly lower in the winter. Exposure to SO_2 is only slightly higher in the winter than in the summer and does not vary markedly with time of day. Exposure to O_3 is, as expected, much higher in the summer than in the winter and shows a pronounced 24-hour variation in the summer. Exposure to nitrates and sulfates is lower in the winter than in the summer.

Despite larger differences between winter and summer concentrations outdoors of most pollutants, differences in time spent outdoors or with window open diminished seasonal differences in exposure.

Figure 7.10 and 7.11 describes variations in the particulate pollutants as a function of time of day and season. Exposure to suspended particles shows a marked 24-hour variation in the winter but not in the summer. This daily variation is not seen in exposure to sulfates and nitrates. This has much to do with the way they were estimated: hour for hour variations in suspended particles were accounted for, whereas nitrate and sulfate estimates were based on 12 hour means.

Figure 7.12 shows the hourly variations in pollen exposure for both grass and birch pollen. Grass pollen shows two peaks, one early in the morning around 0600 and a second one in the middle of the day. Birch pollen seems more evenly emitted with slightly higher values in the morning (see tables in Appendix 4).

In Appendix 5, concentrations of air pollutants are given as a function of weekday. Not unexpectedly, there is little variation by day of the week. Nitrogen dioxide and to a larger degree suspended particles, do show lower values during the weekends where traffic pollution is presumably reduced.



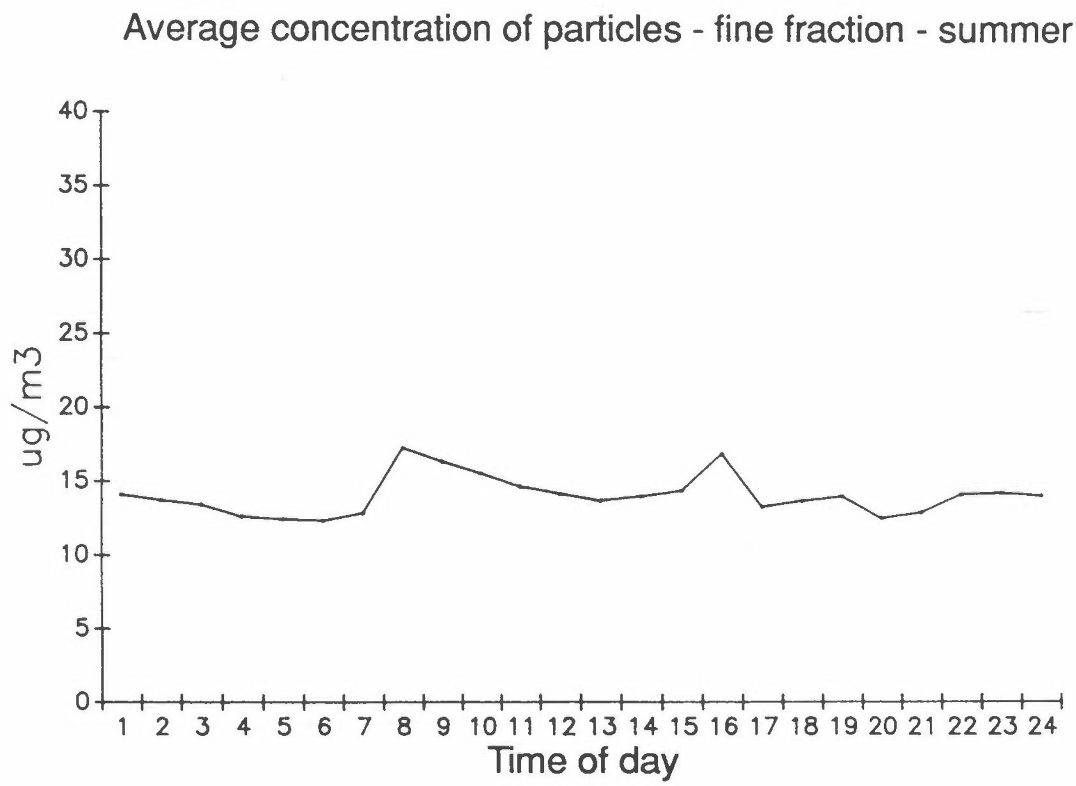
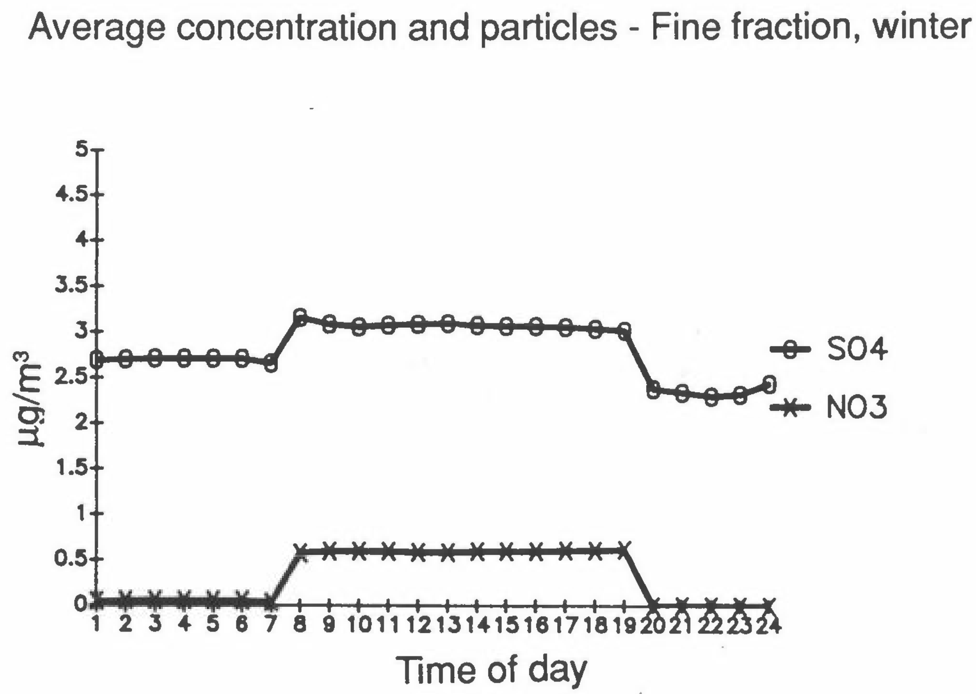


Figure 7.10: Variations in concentration of exposure to suspended particles (fine fraction) as a function of time of day and season.



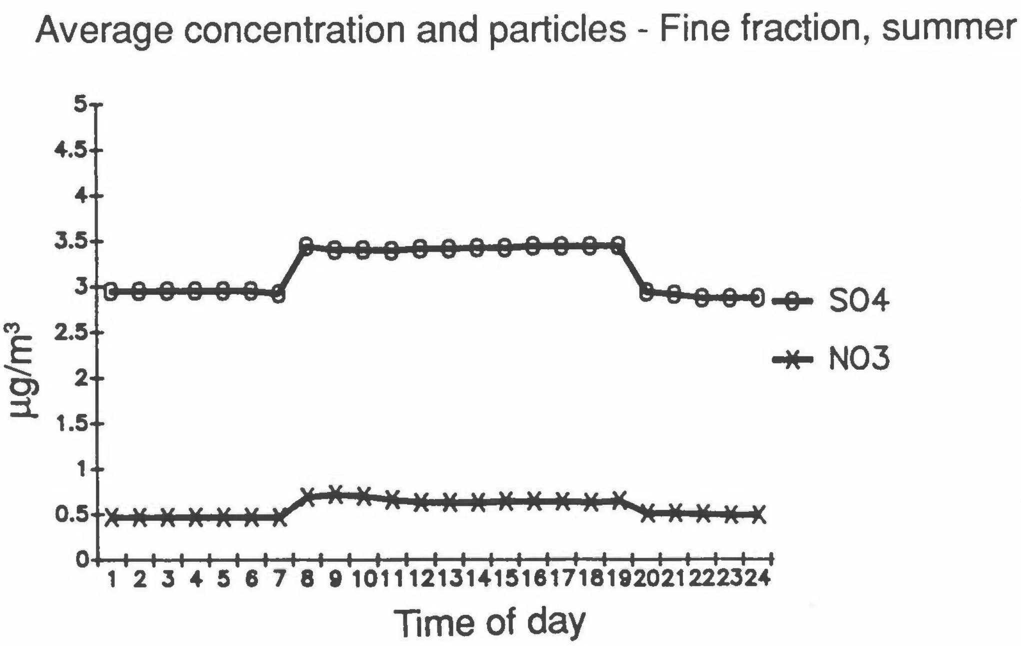


Figure 7.11: Variations in concentration of exposure to the particulate pollutants, sulfate and nitrate as a function of time of day and season.

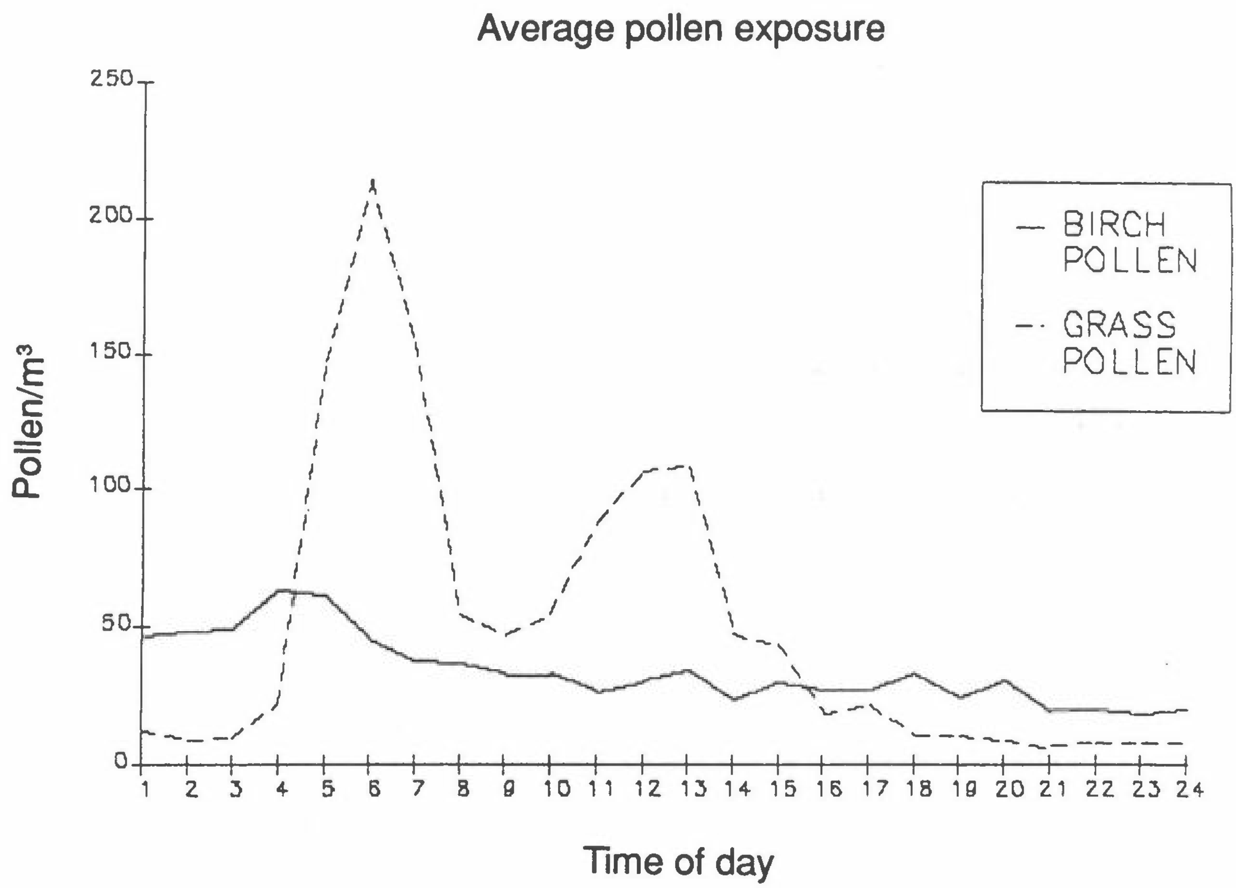


Figure 7.12: Variations in exposure to grass and birch pollen as a function of time of day in summer.

7.5 POLLUTANT CONCENTRATIONS IN DIFFERENT MICRO-ENVIRONMENTS

The results, summarized in Tables 7.4 to 7.13, reflect the fact that the exposure estimate used algorithms to account for special micro-environments. Therefore travelling leads to higher exposure to the nitrous oxides, and indoor values of some pollutants are less than values outdoors or indoors with window open. However, the difference between individual exposure when the participants are indoors and when they are outdoors is less marked than expected. This reflects geographic location and time of day. The tables indicate, however, greater exposure in winter than in summer.

Using Table 7.8 as an example, ozone concentrations increase during the day with sunlight and then decrease at night. Therefore, average exposure in summer estimated when the participants are indoors with window open is on the average lower than when they were outdoors. This may be explained by people being generally outdoors or out driving and shopping in the middle of the day, yet indoors at night (often with window open).

Comparing values in different indoor environments (see Appendix 6) shows very little variation. The variation seen is usually due to the algorithms used in the model (for example higher exposure to suspended particles in micro-environments with smoking) and the location of the environment (shops and industrial areas often lie in regions with higher pollution).

Table 7.4: Concentrations of exposure estimates for all measured pollutants as a function of season. Valid N gives the number of hours used to calculate the characteristics.

	Season	
	Winter	Summer
Sulfur dioxide (µg/m^3)		
Mean	10.9	8.1
Median	9.0	6.0
Std.dev.	10.1	14.3
Valid N	444647	383597
Nitrogen oxides (µg/m^3)		
Mean	28.7	23.3
Median	17.0	16.0
Std.dev.	50.3	48.2
Valid N	444647	383597
Nitrogen dioxide (µg/m^3)		
Mean	15.6	16.4
Median	14.0	13.0
Std.dev.	9.4	13.9
Valid N	444647	383597
Nitrogen monoxide (µg/m^3)		
Mean	13.2	6.9
Median	3.0	2.0
Std.dev.	44.0	38.3
Valid N	444647	383597
Ozone (µg/m^3)		
Mean	8.9	43.0
Median	5.0	24.0
Std.dev.	13.6	37.8
Valid N	444647	383597
Suspended particles fine fraction (µg/m^3)		
Mean	31.1	16.0
Median	16.0	11.0
Std.dev.	34.8	17.2
Valid N	444647	383597
Sulfate (µg/m^3)		
Mean	2.8	3.2
Median	2.0	2.0
Std.dev.	2.5	3.1
Valid N	444647	383591
Nitrate (µg/m^3)		
Mean	.3	.6
Median		
Std.dev.	.9	1.0
Valid N	444647	383591
Chlorine (µg/m^3)		
Mean	4.9	1.7
Median	2.0	1.0
Std.dev.	9.0	1.8
Valid N	115915	52874
Carbon monoxide (mg/m^3)		
Mean	3.4	3.3
Median	2.0	2.0
Std.dev.	3.1	3.0
Valid N	4528	4464
Birch pollen (pollen/m^3)		
Mean	.	34
Median	.	10
Std.dev.	.	72
Valid N		112574
Grass pollen (pollen/m^3)		
Mean	.	59
Median	.	5
Std.dev.	.	189
Valid N		79906
Temperature outdoor (°C)		
Mean	.0	12.7
Median	.1	12.5
Std.dev.	3.0	6.2
Valid N	442683	380892
Temperature (°C)		
Mean	20.9	21.2
Median	22.0	22.0
Std.dev.	4.8	2.8
Valid N	473958	419414
Relative humidity outdoor (%)		
Mean	85.9	65.0
Median	90.0	66.0
Std.dev.	12.3	21.4
Valid N	442683	380892
Relative humidity (%)		
Mean	36.6	39.6
Median	34.7	38.3
Std.dev.	12.1	9.8
Valid N	442683	380892

Table 7.5: Average sulfur dioxide (SO_2) exposure and various environmental factors ($\mu g/m^3$).

	Month					
	January	February	March	April	May	June
Travelling						
Median	12.0	10.0	6.0	5.0	5.0	5.0
Valid N	6398	7713	1574	1568	8307	5227
Mean	14.2	15.1	8.5	7.9	7.4	6.8
Std. Dev.	11.7	16.0	9.4	10.3	11.4	8.1
Indoors						
Median	9.0	9.0	8.0	7.0	7.0	7.0
Valid N	144327	185205	29573	30458	109619	50216
Mean	10.2	10.4	8.8	8.5	8.6	7.6
Std. Dev.	6.3	8.8	7.2	6.9	9.8	6.0
Indoors window open						
Median	8.0	7.0	7.0	4.0	4.0	4.0
Valid N	35425	40431	5750	9390	71474	67553
Mean	10.6	10.9	9.3	8.5	8.1	6.4
Std. Dev.	15.0	17.4	12.6	15.6	25.0	13.9
Outdoors						
Median	8.0	6.0	4.0	4.0	3.0	3.0
Valid N	4837	5920	1479	3544	31654	32204
Mean	10.1	9.1	6.9	6.0	5.1	4.7
Std. Dev.	14.5	13.2	11.5	8.7	8.9	7.8

Table 7.6: Average nitrogen dioxide (NO_2) exposure and various environmental factors ($\mu g/m^3$).

	Month					
	January	February	March	April	May	June
Travelling						
Median	28.0	24.0	16.0	13.0	13.0	13.0
Valid N	6398	7713	1574	1568	8307	5227
Mean	30.1	28.2	24.8	20.5	21.2	19.5
Std. Dev.	18.5	18.3	25.9	28.9	28.2	24.2
Indoors						
Median	14.0	13.0	12.0	13.0	14.0	13.0
Valid N	144327	185205	29573	30458	109619	50216
Mean	13.9	13.2	12.8	14.7	15.6	14.0
Std. Dev.	6.5	5.9	8.0	10.1	10.2	9.6
Indoors window open						
Median	15.0	13.0	10.0	11.0	12.0	10.0
Valid N	35425	40431	5750	9390	71474	67553
Mean	18.8	15.5	14.6	15.3	16.1	14.3
Std. Dev.	15.3	11.9	15.9	15.5	16.0	15.0
Outdoors						
Median	18.0	15.0	8.0	9.0	8.0	9.0
Valid N	4837	5920	1479	3544	31654	32204
Mean	21.0	18.0	15.6	14.6	12.8	12.0
Std. Dev.	17.6	16.9	21.2	18.3	15.5	14.3

Table 7.7: Average nitrogen monoxide (NO) exposure and various environmental factors ($\mu g/m^3$).

	Month					
	January	February	March	April	May	June
Travelling						
Median	13.0	11.0	4.0	2.0	3.0	2.0
Valid N	6398	7713	1574	1568	8307	5227
Mean	59.4	43.3	29.6	18.0	20.3	18.7
Std. Dev.	134.7	105.5	125.3	82.8	89.2	87.9
Indoors						
Median	3.0	3.0	2.0	2.0	2.0	2.0
Valid N	144327	185205	29573	30458	109619	50215
Mean	13.4	9.9	6.3	5.1	6.8	5.6
Std. Dev.	37.3	29.3	30.3	27.4	27.5	30.9
Indoors window open						
Median	2.0	1.0	1.0	1.0	2.0	1.0
Valid N	35425	40431	5750	9390	71474	67553
Mean	13.6	8.9	6.3	4.9	6.7	5.3
Std. Dev.	47.3	40.1	40.5	36.3	39.9	37.4
Outdoors						
Median	4.0	4.0	1.0	2.0	1.0	1.0
Valid N	4837	5920	1479	3544	31654	32204
Mean	26.7	20.6	12.3	8.1	5.0	4.5
Std. Dev.	73.8	70.7	63.4	43.3	26.0	34.4

Table 7.8: Average ozone (O_3) exposure and various environmental factors ($\mu g/m^3$).

	Month					
	January	February	March	April	May	June
Travelling						
Median	5.0	16.0	45.0	80.0	89.0	77.0
Valid N	6398	7713	1574	1568	8307	5227
Mean	12.8	19.3	40.1	75.8	83.3	71.0
Std. Dev.	15.9	18.7	21.2	25.2	38.6	26.9
Indoors						
Median	1.0	4.0	9.0	13.0	13.0	13.0
Valid N	144327	185205	29573	30458	109619	50216
Mean	3.4	4.6	7.7	13.5	13.3	12.7
Std. Dev.	4.1	4.5	6.0	8.5	10.9	9.4
Indoors window open						
Median	15.0	24.0	50.0	59.0	65.0	56.0
Valid N	35425	40431	5750	9390	71474	67553
Mean	20.8	24.3	44.3	58.1	61.5	51.8
Std. Dev.	21.0	18.6	22.2	25.1	40.8	31.2
Outdoors						
Median	.5	6.0	19.0	78.0	83.0	70.0
Valid N	4837	5920	1479	3544	31654	32204
Mean	11.9	16.1	25.6	67.1	71.0	56.5
Std. Dev.	16.5	19.2	26.0	34.9	50.0	39.0

Table 7.9: Average carbon monoxide (CO) under various environmental conditions (mg/m^3).

	Month					
	January	February	March	April	May	June
Travelling						
Median						
Valid N	6388	7713	1574	1568	8307	5227
Mean	.2	.2	.2	.2	.2	.2
Std. Dev.	1.2	1.1	1.4	1.1	1.1	1.1
Indoors						
Median						
Valid N	137381	176138	26371	28577	102108	46333
Mean	.0	.0	.0	.0	.0	.0
Std. Dev.	.4	.4	.5	.4	.4	.5
Indoors window open						
Median						
Valid N	33824	39200	5382	9086	66677	62790
Mean	.0	.0	.0	.0	.0	.0
Std. Dev.	.4	.4	.4	.4	.5	.5
Outdoors						
Median						
Valid N	3906	4564	962	3037	24524	24049
Mean	.1	.1	.1	.1	.0	.0
Std. Dev.	.6	.7	.8	.5	.3	.5

Table 7.10: Average chlorine (Cl_x) exposure and various environmental factors ($\mu g/m^3$).

	Month					
	January	February	March	April	May	June
Travelling						
Median	.5	.5	.5	.5	.5	.5
Valid N	6398	7713	1574	1568	8307	5227
Mean	2.2	1.7	1.1	.6	.6	.7
Std. Dev.	5.1	2.5	1.5	.3	.2	.5
Indoors						
Median	.5	.5	.5	.5	.5	.5
Valid N	144327	185205	29573	30458	109619	50216
Mean	1.6	1.2	1.0	.6	.6	.6
Std. Dev.	4.7	2.9	2.2	.3	.4	.6
Indoors window open						
Median	.5	.5	.5	.5	.5	.5
Valid N	35425	40431	5750	9390	71474	67553
Mean	3.0	1.9	1.0	.7	.7	.8
Std. Dev.	10.2	5.5	2.2	.7	.9	1.3
Outdoors						
Median	.5	.5	.5	.5	.5	.5
Valid N	4837	5920	1479	3544	31654	32204
Mean	2.3	2.4	1.5	.7	.6	.7
Std. Dev.	8.2	8.3	4.4	.8	.6	.6

Table 7.11: Average exposure to suspended particles (fine fraction) and various environmental factors (μg/m³).

	Month					
	January	February	March	April	May	June
Travelling						
Median	15.0	14.0	11.0	11.0	10.0	11.0
Valid N	6398	7713	1574	1568	8307	5227
Mean	19.7	18.6	13.0	13.3	13.9	13.4
Std. Dev.	16.4	15.4	12.8	11.6	12.2	10.2
Indoors						
Median	22.0	22.0	13.0	10.0	11.0	11.0
Valid N	144327	185205	29573	30458	109619	50216
Mean	34.2	34.6	33.9	17.4	18.4	17.4
Std. Dev.	37.2	36.7	38.2	19.4	19.6	20.0
Indoors window open						
Median	9.0	10.0	10.0	7.0	10.0	9.0
Valid N	35425	40431	5750	9390	71474	67553
Mean	14.6	12.8	11.6	11.7	13.7	12.3
Std. Dev.	20.2	12.8	9.7	12.5	13.7	16.2
Outdoors						
Median	10.0	9.0	7.0	7.0	7.0	7.0
Valid N	4837	5920	1479	3544	31654	32204
Mean	14.0	13.9	9.3	11.1	9.9	8.9
Std. Dev.	16.2	18.3	12.3	13.0	10.7	10.4

Table 7.12: Average nitrates (NO_3^-) exposure and various environmental factors (μg/m³).

	Month					
	January	February	March	April	May	June
Travelling						
Median	.5	.5	.5	.5	.5	.5
Valid N	6398	7713	1574	1568	8307	5227
Mean	.9	.8	.6	.6	.8	.7
Std. Dev.	.8	.6	.2	.4	.6	.4
Indoors						
Median	.5	.5	.5	1.0	1.0	.5
Valid N	144327	185205	29573	30458	109619	50216
Mean	.8	.7	.6	.9	1.0	.8
Std. Dev.	.6	.4	.3	.6	.8	.5
Indoors window open						
Median	.5	.5	.5	.5	.5	.5
Valid N	35425	40431	5750	9390	71474	67553
Mean	.9	.7	.6	.8	.8	.7
Std. Dev.	.9	.6	.4	.9	.8	.6
Outdoors						
Median	.5	.5	.5	.5	.5	.5
Valid N	4837	5920	1479	3544	31654	32204
Mean	.8	.7	.6	.6	.7	.6
Std. Dev.	.7	.6	.3	.3	.6	.4

Table 7.13: Average sulfates (SO_4^{2-}) exposure and various environmental factors ($\mu g/m^3$).

	Month					
	January	February	March	April	May	June
Travelling						
Median	3.0	2.0	2.0	1.0	2.0	2.0
Valid N	6398	7713	1574	1568	8307	5227
Mean	3.5	3.7	3.0	3.2	3.8	3.3
Std. Dev.	2.0	3.7	2.1	3.6	3.9	2.6
Indoors						
Median	2.0	2.0	2.0	1.0	2.0	2.0
Valid N	144327	185205	29573	30458	109619	50216
Mean	2.5	2.7	2.4	2.4	3.4	2.5
Std. Dev.	1.6	2.7	2.0	2.5	3.2	2.1
Indoors window open						
Median	3.0	2.0	2.0	1.0	2.0	2.0
Valid N	35425	40431	5750	9390	71474	67553
Mean	3.3	3.2	3.8	2.4	3.6	2.5
Std. Dev.	2.0	3.3	3.3	2.8	3.6	2.3
Outdoors						
Median	3.0	2.0	2.0	1.0	1.0	1.0
Valid N	4837	5920	1479	3544	31654	32204
Mean	2.9	2.9	2.5	2.5	2.9	2.1
Std. Dev.	2.1	3.5	2.3	3.3	3.4	2.2

7.6 VARIATIONS IN EXPOSURE TO POLLUTION IN DIFFERENT POPULATION SUBGROUPS

Variations in exposure to pollutants between adults in the group based on a random sample, and those selected with pre-existing lung disease and in children with pre-existing lung disease, are shown in Appendix 7. Children with pre-existing lung disease had lower ozone exposure in the summer, higher exposure to suspended particles in the winter and lower pollen exposure.

Variations in exposure between men and women are shown in Tables 7.14 to 7.16. There were slight differences between the two sexes. However, all parameters were either equal or slightly higher in men, with the exception of suspended particles (Tables 7.14 and 7.15). In Table 7.16 one can see that men are exposed to slightly higher concentrations of the nitrous oxide components and this is especially so in the younger men, indicating more exposure to traffic pollutants. Both older men

Table 7.14: Differences in exposure to various pollutants as a function of sex.

	Sex	
	Women	Men
Sulfur dioxide ($\mu g/m^3$)		
Mean	9.5	9.7
Median	8.0	8.0
Std.dev.	12.6	12.1
Valid N	420854	407390
Nitrogen oxides ($\mu g/m^3$)		
Mean	25.0	27.4
Median	16.0	17.0
Std.dev.	43.5	54.8
Valid N	420854	407390
Nitrogen dioxide ($\mu g/m^3$)		
Mean	15.6	16.2
Median	14.0	14.0
Std.dev.	11.1	12.3
Valid N	420854	407390
Nitrogen monoxide ($\mu g/m^3$)		
Mean	9.4	11.2
Median	2.0	2.0
Std.dev.	36.2	46.4
Valid N	420854	407390
Ozone ($\mu g/m^3$)		
Mean	24.7	24.8
Median	10.0	10.0
Std.dev.	32.4	32.4
Valid N	420854	407390
Suspended particles fine fraction ($\mu g/m^3$)		
Mean	25.6	22.6
Median	13.0	12.0
Std.dev.	30.3	27.6
Valid N	420854	407390
Sulfate ($\mu g/m^3$)		
Mean	3.0	3.0
Median	2.0	2.0
Std.dev.	2.8	2.8
Valid N	420854	407384
Nitrate ($\mu g/m^3$)		
Mean	.4	.4
Median		
Std.dev.	1.0	.9
Valid N	420854	407384
Chlorine ($\mu g/m^3$)		
Mean	3.7	4.0
Median	2.0	2.0
Std.dev.	6.9	8.3
Valid N	82222	86567
Carbon monoxide (mg/m^3)		
Mean	3.5	3.3
Median	2.0	2.0
Std.dev.	3.1	3.0
Valid N	3766	5226
Birch pollen ($pollen/m^3$)		
Mean	35	34
Median	10	10
Std.dev.	73	71
Valid N	57007	55567
Grass pollen ($pollen/m^3$)		
Mean	59	59
Median	5	5
Std.dev.	188	189
Valid N	40238	39668
Temperature outdoor (^oC)		
Mean	5.8	5.9
Median	3.3	3.4
Std.dev.	7.9	7.9
Valid N	418696	404879
Temperature (^oC)		
Mean	21.3	20.8
Median	22.0	22.0
Std.dev.	3.4	4.5
Valid N	454609	438763
Relative humidity outdoor (%)		
Mean	76.2	76.2
Median	84.0	84.0
Std.dev.	20.0	20.0
Valid N	418696	404879
Relative humidity (%)		
Mean	37.3	38.7
Median	35.8	36.1
Std.dev.	9.9	12.3
Valid N	418696	404879

Table 7.15: Differences in exposure to pollutants as a function of season and sex.

	Winter		Summer	
	Women	Men	Women	Men
Sulfur dioxide ($\mu g/m^3$)				
Mean	10.8	11.0	8.0	8.2
Median	9.0	9.0	6.0	6.0
Std.dev.	10.0	10.3	14.9	13.8
Valid N	227175	217472	193679	189918
Nitrogen oxides ($\mu g/m^3$)				
Mean	27.3	30.2	22.4	24.2
Median	17.0	17.0	16.0	16.0
Std.dev.	42.7	57.1	44.2	52.0
Valid N	227175	217472	193679	189918
Nitrogen dioxide ($\mu g/m^3$)				
Mean	15.3	15.8	16.1	16.7
Median	14.0	14.0	13.0	13.0
Std.dev.	8.8	10.0	13.3	14.5
Valid N	227175	217472	193679	189918
Nitrogen monoxide ($\mu g/m^3$)				
Mean	12.0	14.4	6.3	7.5
Median	3.0	3.0	2.0	2.0
Std.dev.	37.1	50.1	34.8	41.5
Valid N	227175	217472	193679	189918
Ozone ($\mu g/m^3$)				
Mean	8.9	8.9	43.1	43.0
Median	5.0	4.0	24.0	25.0
Std.dev.	13.5	13.6	37.9	37.6
Valid N	227175	217472	193679	189918
Suspended particles fine fraction ($\mu g/m^3$)				
Mean	33.5	28.5	16.3	15.7
Median	18.0	15.0	11.0	10.0
Std.dev.	36.4	33.0	16.9	17.5
Valid N	227175	217472	193679	189918
Sulfate ($\mu g/m^3$)				
Mean	2.8	2.8	3.2	3.2
Median	2.0	2.0	2.0	2.0
Std.dev.	2.5	2.5	3.1	3.0
Valid N	227175	217472	193679	189912
Nitrate ($\mu g/m^3$)				
Mean	.3	.3	.6	.6
Median				
Std.dev.	.9	.9	1.2	.9
Valid N	227175	217472	193679	189912
Chlorine ($\mu g/m^3$)				
Mean	4.7	5.1	1.6	1.7
Median	2.0	2.0	1.0	1.0
Std.dev.	8.1	9.8	1.6	2.0
Valid N	56495	59420	25727	27147
Carbon monoxide (mg/m^3)				
Mean	3.5	3.4	3.5	3.2
Median	2.0	2.0	2.0	2.0
Std.dev.	3.1	3.1	3.1	2.9
Valid N	1966	2562	1800	2664
Birch pollen ($pollen/m^3$)				
Mean	.	.	35	34
Median	.	.	10	10
Std.dev.	.	.	73	71
Valid N			57007	55567
Grass pollen ($pollen/m^3$)				
Mean	.	.	59	59
Median	.	.	5	5
Std.dev.	.	.	188	189
Valid N			40238	39668
Temperature outdoor (^oC)				
Mean	.0	.0	12.7	12.7
Median	.1	.1	12.5	12.5
Std.dev.	3.0	3.0	6.2	6.2
Valid N	226345	216338	192351	188541
Temperature (^oC)				
Mean	21.2	20.6	21.4	21.0
Median	22.0	22.0	22.0	22.0
Std.dev.	4.2	5.4	2.3	3.1
Valid N	241541	232417	213068	206346
Relative humidity outdoor (%)				
Mean	85.9	85.9	64.9	65.0
Median	90.0	90.0	66.0	66.0
Std.dev.	12.3	12.3	21.4	21.4
Valid N	226345	216338	192351	188541
Relative humidity (%)				
Mean	35.9	37.4	39.0	40.2
Median	34.6	34.7	38.0	38.5
Std.dev.	10.6	13.5	8.8	10.7
Valid N	226345	216338	192351	188541

Table 7.16: Differences in exposure to pollutants in men and women as a function of season and age.

		Winter				Summer			
		Women		Men		Women		Men	
		Age (years)		Age (years)		Age (years)		Age (years)	
		Under 45	Over 45	Under 45	Over 45	Under 45	Over 45	Under 45	Over 45
Sulfur dioxide	(µg/m^3)								
Mean		10.7	11.0	10.7	11.4	7.9	8.2	7.9	8.5
Median		9.0	9.0	9.0	9.0	6.0	6.0	6.0	7.0
Std.dev.		9.6	10.5	9.1	11.5	14.3	15.9	12.5	15.1
Valid N		143630	83545	115804	101668	123235	70444	100922	88996
Nitrogen oxides	(µg/m^3)								
Mean		27.1	27.6	30.9	29.4	22.7	21.8	25.5	22.8
Median		17.0	17.0	17.0	17.0	16.0	16.0	15.0	16.0
Std.dev.		44.8	38.8	63.0	49.4	49.3	33.2	62.5	36.5
Valid N		143630	83545	115804	101668	123235	70444	100922	88996
Nitrogen dioxide	(µg/m^3)								
Mean		15.1	15.6	15.9	15.8	15.9	16.3	16.7	16.7
Median		14.0	14.0	14.0	14.0	13.0	14.0	13.0	13.0
Std.dev.		8.7	9.0	10.2	9.6	13.6	12.7	15.5	13.2
Valid N		143630	83545	115804	101668	123235	70444	100922	88996
Nitrogen monoxide	(µg/m^3)								
Mean		12.0	12.0	15.1	13.6	6.7	5.5	8.8	6.1
Median		3.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0
Std.dev.		39.1	33.4	55.5	43.1	39.5	24.6	50.7	27.5
Valid N		143630	83545	115804	101668	123235	70444	100922	88996
Ozone	(µg/m^3)								
Mean		8.5	9.7	8.5	9.5	41.9	45.1	42.4	43.6
Median		5.0	5.0	4.0	5.0	23.0	30.0	23.0	27.0
Std.dev.		12.9	14.5	13.1	14.2	37.7	38.2	37.7	37.5
Valid N		143630	83545	115804	101668	123235	70444	100922	88996
Suspended particles fine fraction	(µg/m^3)								
Mean		35.8	29.6	30.0	26.8	16.9	15.2	16.7	14.6
Median		21.0	15.0	17.0	13.0	11.0	10.0	11.0	10.0
Std.dev.		37.6	33.8	33.2	32.6	17.4	16.0	18.7	15.9
Valid N		143630	83545	115804	101668	123235	70444	100922	88996
Sulfate	(µg/m^3)								
Mean		2.8	2.9	2.8	2.8	3.1	3.3	3.1	3.2
Median		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Std.dev.		2.4	2.5	2.5	2.5	3.1	3.1	3.0	3.1
Valid N		143630	83545	115804	101668	123235	70444	100916	88996
Nitrate	(µg/m^3)								
Mean		.3	.3	.3	.3	.6	.6	.6	.6
Median									
Std.dev.		.9	.9	.9	.9	1.3	.9	.9	.9
Valid N		143630	83545	115804	101668	123235	70444	100916	88996
Chlorine	(µg/m^3)								
Mean		4.5	5.0	5.3	4.9	1.5	1.7	1.8	1.7
Median		2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0
Std.dev.		7.4	9.1	10.4	8.9	1.4	1.9	2.1	1.8
Valid N		34969	21526	33443	25977	15519	10208	14625	12522
Carbon monoxide	(mg/m^3)								
Mean		3.6	3.3	3.7	2.8	3.5	3.6	3.7	2.4
Median		2.0	2.0	3.0	2.0	2.0	2.0	3.0	2.0
Std.dev.		3.1	3.1	3.3	2.7	3.2	3.0	3.2	2.1
Valid N		1471	495	1640	922	1416	384	1693	971

Table 7.16, cont.

	Winter				Summer			
	Women		Men		Women		Men	
	Age (years)		Age (years)		Age (years)		Age (years)	
	Under 45	Over 45	Under 45	Over 45	Under 45	Over 45	Under 45	Over 45
Birch pollen (pollen/m^3)								
Mean	.	.	.	.	34	36	33	34
Median	.	.	.	.	8	10	9	10
Std.dev.	.	.	.	.	72	75	70	72
Valid N					36138	20869	30282	25285
Grass pollen (pollen/m^3)								
Mean	.	.	.	.	56	63	55	63
Median	.	.	.	.	5	9	5	7
Std.dev.	.	.	.	.	183	196	181	199
Valid N					25273	14965	21240	18428
Temperature outdoor (°C)								
Mean	.0	.0	.0	.0	12.6	12.8	12.8	12.6
Median	.1		.1	.1	12.4	12.5	12.5	12.4
Std.dev.	2.9	3.0	3.0	3.0	6.2	6.1	6.1	6.3
Valid N	143044	83301	115055	101283	122292	70059	100076	88465
Temperature (°C)								
Mean	21.2	21.1	20.5	20.7	21.4	21.4	20.9	21.1
Median	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Std.dev.	4.1	4.2	5.6	5.2	2.3	2.3	3.2	3.0
Valid N	152771	88770	124392	108025	134716	78352	108496	97850
Relative humidity outdoor (%)								
Mean	85.8	86.0	86.0	85.7	64.7	65.3	64.9	65.1
Median	90.0	90.0	91.0	90.0	65.0	67.0	66.0	66.0
Std.dev.	12.4	12.1	12.2	12.4	21.4	21.4	21.4	21.4
Valid N	143044	83301	115055	101283	122292	70059	100076	88465
Relative humidity (%)								
Mean	35.8	36.0	37.7	37.1	38.9	39.1	40.5	39.9
Median	34.6	34.6	34.8	34.7	38.0	38.2	38.6	38.5
Std.dev.	10.4	10.9	13.9	13.0	8.9	8.7	11.0	10.3
Valid N	143044	83301	115055	101283	122292	70059	100076	88465

and women have higher exposure to ozone, possibly indicating more time spent outdoors, or more time in areas without traffic pollution. The higher exposure to suspended particles in women is especially evident in younger women, although younger men are also exposed to higher concentrations than older men. This indicates the increased exposure to tobacco smoke in the young as opposed to the elderly and in women as opposed to men.

Table 7.17 details this exposure to suspended particles as a function of smoking and season. Non-smokers are slightly more exposed in the winter than in the summer to particles. The difference between winter and summer is slightly more noticeable in occasional smokers, and even more marked in daily smokers. There is a mean difference of 32 $\mu g/m^3$ exposure to suspended particles in the winter, between non-smokers and those who smoke every day; whereas that difference is only 10.2 $\mu g/m^3$ in the summer. This is a direct reflection of time spent outdoors, or with window open in the summer as opposed to the winter.

Table 7.17: Differences in exposure to suspended particles (fine fraction) in non-smokers, occasional smokers and daily smokers in winter and summer.

Smoking habits	Suspended particles, fine fraction ($\mu g/m^3$)			
	Mean	Median	Std.dev.	Valid N
Non-smokers				
Season				
Winter	18.6	10.0	22.4	243 591
Summer	12.5	9.0	13.6	214 490
Occasional smokers				
Season				
Winter	24.9	13.0	28.4	46 608
Summer	14.2	10.0	15.0	43 773
Daily smokers				
Season				
Winter	52.6	44.0	41.7	154 448
Summer	22.7	14.0	21.0	125 334

7.7 FREQUENCY DISTRIBUTION OF THE COMPONENTS

The logarithmic transformation was chosen for further analysis of the air pollutants. The frequency distribution is shown in Appendix 8.

7.8 EXPOSURE TO POLLUTANTS THROUGH UNUSUAL ACTIVITIES

Table 7.18 shows number of hours of registered exposure of the population subgroups to additional pollutants (e.g. fixing a house, emptying a vacuum cleaner) that was described on a daily basis by each individual.

Table 7.18: Possible exposure to pollution due to special activities (hours).

Population subgroups	Month					
	January	February	March	April	May	June
Adults - randomly chosen						
Not exposed to extraneous pollution	150573	194645	34583	37597	184676	127276
Little exposure risk to extraneous pollution	105	142	37	26	175	72
Risk of exposure to extraneous pollution	546	622	182	249	884	479
Children - lung disease						
Not exposed to extraneous pollution	8904	10617	1632	1656	10413	7271
Little exposure risk to extraneous pollution	1					
Risk of exposure to extraneous pollution	47	15			3	1
Adults - lung disease						
Not exposed to extraneous pollution	33063	39913	4038	6750	38597	28289
Little exposure risk to extraneous pollution	39	19		20	57	23
Risk of exposure to extraneous pollution	138	52	18	46	178	224

Generally, adults with pre-existing lung disease seem to report exposure less often than the random population in winter, and more often in summer.

8 COMPARISON OF ESTIMATED HOURLY, 8-HOURLY AND 24-HOURLY EXPOSURE TO FIXED SITE OUTDOOR CONCENTRATIONS

An interesting way to summarize the information presented on exposure estimates is to examine how often air quality guidelines are exceeded. In Chapter 4, this information was provided for each air quality measuring station and for the components SO_2, NO_2, O_3 and suspended particles. Norwegian air quality guidelines were provided, where they exist (SFT, 1982). Otherwise, WHO guidelines were given (WHO, 1987).

Tables 8.1 and 8.2 compare the information for the exposure estimates with the guidelines presented. Guidelines are meant to apply to outdoor monitoring stations. However, it is of interest to see how, and possibly when, where or why individual exposures exceed these guidelines adding another dimension in the use and interpretation of these guidelines. For SO_2 it can be seen that for a total of 23 hours in the winter (19 individuals) and for 80 hours in the summer (48 individuals) the air quality guidelines were exceeded as opposed to a maximum of 6 hours in Skien (both G. Stangs gt. and Skien brannstasjon) in the winter and none in the summer for measurements made at the air quality stations. For the 24 hour measurement the results are different. There were only two days in the summer (2 individuals) where the exposure estimate exceeded the 24-hour air quality guidelines, whereas none occurred in the winter. There was a maximum of 2 days in the winter for the measuring stations.

No measured values of NO_2 ever exceeded either the 1-hour or 24-hour air quality guidelines, either in winter, or summer at any station. However, the 1-hour limit was exceeded 18 times (15 individuals) in the winter and 135 times (63 individuals) in the summer, and the daily limit twice in the winter (1 individual), based on exposure estimates.

Table 8.1: Number of days individual exposure to SO_2, NO_2, O_3 and suspended particles exceeded the 24-hour air quality guideline (AQG) by season and population sub-group. Number of individuals with at least one exceedance in parenthesis.

SEASON	No. person days	SO_2 mean per day	NO_2 mean per day	O_3 mean per 8-hr	SP mean per day	Number of partici-pants
		Days over AQG	Days over AQG	Days over AQG	Days over AQG	
WINTER						
Population subgroup						
Adults based on random	15362				1920 (113)	290
Children with lung disease	855		2 (1)		27 (3)	16
Adults with lung disease	3114				114 (13)	59
SUMMER						
Population subgroup						
Adults based on random	13712	2 (2)		304 (136)	10 (6)	260
Children with lung disease	756			13 (5)	3 (1)	14
Adults with lung disease	2872			94 (32)		54
Air Quality Guidelines		100 Norway	100 Norway	100 WHO	70 WHO	

Table 8.2: Number of hours individual exposure to SO_2, NO_2, O_3 and suspended particles exceeded the 1 hour AQG by season and population sub-group. Number of individuals with at least one exceedance in parenthesis.

SEASON	No. person days	SO_2 over 1 hour	NO_2 over 1 hour	O_3 over 1 hour	Number of partici-pants
		Hours over AQG	Hours over AQG	Hours over AQG	
WINTER					
Population subgroup					
Adults based on random	15362	18 (14)	17 (14)		290
Children with lung disease	855	1 (1)			16
Adults with lung disease	3114	4 (4)	1 (1)		59
SUMMER					
Population subgroup					
Adults based on random	13712	69 (41)	107 (50)	25778 (260)	260
Children with lung disease	756	1 (1)	2 (2)	1661 (14)	14
Adults with lung disease	2872	10 (6)	26 (11)	6153 (54)	54
Air Quality Guidelines		350 WHO	200 Norway	100 Norway	

Neither measured values nor estimated exposure of ozone ever exceeded the guidelines in the winter. However, in the summer, measurements at Ås exceeded the 1-hour guideline 406 times and the 8-hour limit 35 times. This can be compared to 33 592 times (8%) (328 individuals) the exposure estimate exceeded the 1-hour limit, and 411 times (173 individuals) the estimate exceeded the 8-hour limit (24 hour means used here).

No values of suspended particles ever exceeded air quality guidelines at any of the air quality measuring stations. However, 2 061 times (129 individuals) the 24-hour limit was exceeded by the exposure estimate in the winter and 13 times (7 individuals) in the summer (Table 8.1).

9 APPLICATION OF EXPOSURE ESTIMATES IN ASSESSING THE HEALTH EFFECTS OF AIR POLLUTION

Participants exposure is summarized in Table 9.1. The table shows exposure percentiles and maximum estimated exposure for winter and summer.

The diary method used in this investigation has its limitations but seems the preferred method of investigation of short term health effects. It allows measuring more individuals over a greater time period, and over shorter time intervals and estimates more pollution compounds than an ideal method (portable pollution measuring equipment) could possibly do. It allows relating concentrations of pollution concentrations measured at fixed site stations to individual differences in exposure due to lifestyle.

Collecting data on an hourly basis allows a great deal of flexibility in the analysis phase. Symptoms can be compared to exposure estimates the same hour, the previous hour, the previous 4, 8 hours, etc. It may be desirable to compress the data. Data compression can be done: every 4 hours; based on

Table 9.1: Percentiles of the calculated exposure to air pollutants for the randomly selected study population and adults with pre-existing lung disease.

Randomly selected Study population	Hours registered	10% quantile	Median	90% quantile	95% quantile	Maximum
Winter						
Sulfur dioxide (µg/m^3)	354735	5	9	18	22	900
Nitrogen oxides (µg/m^3)	354735	8	17	55	85	3065
Nitrogen dioxide (µg/m^3)	354735	8	14	23	33	334
Nitrogen monoxide (µg/m^3)	354735	0	3	31	61	2731
Ozone (µg/m^3)	354735	0	4	28	41	93
Carbon monoxide (mg/m^3)	354735	0	0	0	0	31
Particles (fine fr.) (µg/m^3)	354735	2	17	101	108	581
Sulfate (µg/m^3)	354735	0	2	6	8	17
Nitrate (µg/m^3)	354735	0	0	1	2	8
Chlorine (µg/m^3)	354735	0	0	3	7	297
Summer						
Sulfur dioxide (µg/m^3)	304697	2	7	13	19	1414
Nitrogen oxides (µg/m^3)	304697	6	16	40	55	2313
Nitrogen dioxide (µg/m^3)	304697	6	14	30	39	325
Nitrogen monoxide (µg/m^3)	304697	0	2	9	17	2033
Ozone (µg/m^3)	304697	5	24	97	112	185
Carbon monoxide (mg/m^3)	304697	0	0	0	0	23
Particles (fine fr.) (µg/m^3)	304697	2	11	44	53	614
Sulfate (µg/m^3)	304697	1	2	8	10	15
Nitrate (µg/m^3)	304697	0	0	1	2	9
Chlorine (µg/m^3)	304697	0	0	1	1	55
Birch pollen (pollen/m^3)	325387	0	0	17	47	833
Grass pollen (pollen/m^3)	324534	0	0	5	19	2185

Adults and children with pre-existing lung disease	Hours registered	10% quantile	Median	90% quantile	95% quantile	Maximum
Winter						
Sulfur dioxide (µg/m^3)	89912	5	9	17	22	446
Nitrogen oxides (µg/m^3)	89912	8	16	52	79	1912
Nitrogen dioxide (µg/m^3)	89912	7	13	25	33	214
Nitrogen monoxide (µg/m^3)	89912	0	2	26	54	1698
Ozone (µg/m^3)	89912	0	5	31	42	91
Carbon monoxide (mg/m^3)	89912	0	0	0	0	36
Particles (fine fr.) (µg/m^3)	89912	0	13	58	89	485
Sulfate (µg/m^3)	89912	1	2	6	9	16
Nitrate (µg/m^3)	89912	0	0	1	2	8
Chlorine (µg/m^3)	89912	0	0	3	6	269
Summer						
Sulfur dioxide (µg/m^3)	78900	1	6	13	18	1414
Nitrogen oxides (µg/m^3)	78900	4	14	39	54	2518
Nitrogen dioxide (µg/m^3)	78900	4	12	31	40	324
Nitrogen monoxide (µg/m^3)	78900	0	2	8	15	2218
Ozone (µg/m^3)	78900	6	27	100	114	184
Carbon monoxide (mg/m^3)	78900	0	0	0	0	25
Particles (fine fr.) (µg/m^3)	78900	1	10	31	47	424
Sulfate (µg/m^3)	78894	1	2	8	10	14
Nitrate (µg/m^3)	78894	0	0	1	2	8
Chlorine (µg/m^3)	78900	0	0	1	1	55
Birch pollen (pollen/m^3)	85856	0	0	14	43	833
Grass pollen (pollen/m^3)	84892	0	0	5	24	2185

pollution concentrations (for example which exposure is low for all compounds); by activity (while sleeping); or finally by presence in a micro-environment. (NILU/NIPH, 1991; Clench-Aas et al., 1992).

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APPENDIX 1

Presence in each square kilometer zone
when at home, at work, at school/daycare center,
and at other locations.
First table separately for winter and summer,
the second table combined for both seasons.

Many of the following appendices refer to
X and Y coordinates from a grid.

The given map shows the grid system.

Abbreviations used:

NR = Not Relevant
ycoo = y coordinate
NO. = Number of hours registered

Lower Telemark (1 km per square)

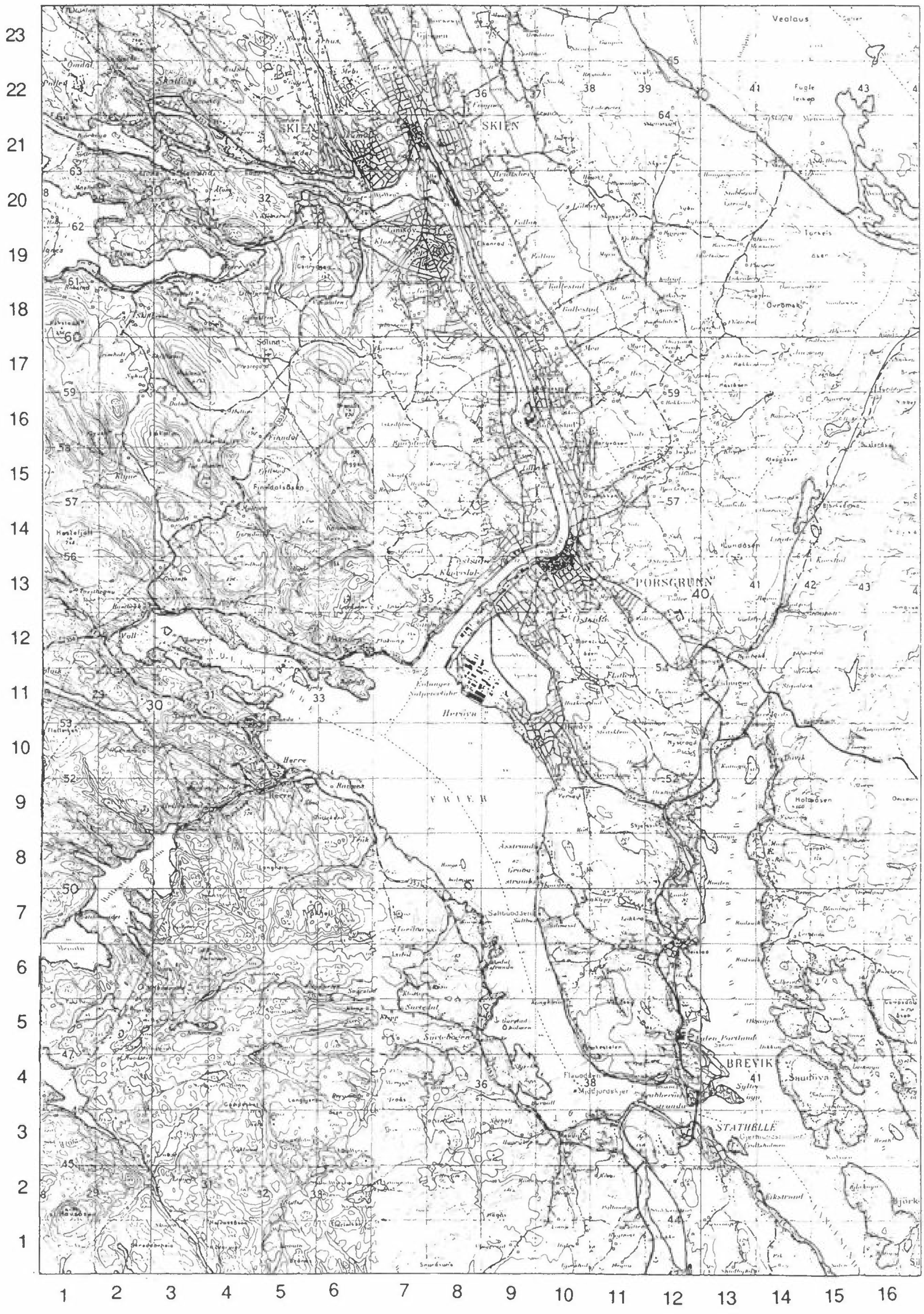


Table A1: Home

	X-coordinate																			
	NR		1		2		3		4		5		6		7		8		9	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Season																				
Winter																				
Ycoo																				
NR																				
1																				
2																				
3																				
4																				
5																	874	.1		
6																				
7																				
8																				
9																				
10																			994	.2
11																				
12					1105	.2											574	.1	4625	.7
13																	782	.1	3056	.5
14																	4024	.6	11216	1.8
15																	2691	.4	9537	1.5
16																	793	.1	3802	.6
17															2029	.3			1201	.2
18													1911	.3	4692	.7	4094	.6	828	.1
19									1645	.3			5318	.8	5854	.9	12229	1.9		
20							1129	.2			4750	.7	2771	.4	8674	1.4	9744	1.5	3209	.5
21							767	.1	869	.1	5651	.9	10346	1.6	12235	1.9	20133	3.2		
22					977	.2					6040	1.0	7193	1.1	6482	1.0			1170	.2
23									2571	.4			927	.1	882	.1				
City																				
Country																				
Summer																				
Ycoo																				
NR																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12					1026	.2											446	.1	4489	.7
13																	392	.1	2722	.4
14																	3919	.6	9914	1.6
15																	1814	.3	9946	1.6
16																	803	.1	3944	.6
17															2000	.3			676	.1
18													1700	.3	4239	.7	3406	.5	871	.1
19									835	.1			5415	.9	3780	.6	9091	1.4		
20							1305	.2			4171	.7	1973	.3	7960	1.3	7785	1.2	3155	.5
21							658	.1			4397	.7	10733	1.7	11193	1.8	17446	2.8		
22					1353	.2					5991	.9	5715	.9	5873	.9			1035	.2
23									2307	.4			1194	.2	870	.1				
City																				
Country																				

Table A1: cont.

	X-coordinate																	
	10		11		12		13		14		15		16		City		Country	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Season																		
Winter																		
Ycoo																		
NR																		
1							1052	.2										
2																		
3			1158	.2			936	.1										
4					3140	.5	5363	.8										
5					2090	.3												
6					2974	.5												
7			6102	1.0	4983	.8												
8	2028	.3	593	.1	7977	1.3												
9			4908	.8	1332	.2	1040	.2										
10	12741	2.0	11872	1.9	2522	.4												
11	6206	1.0	9227	1.5			865	.1										
12	6053	1.0			1219	.2												
13	14738	2.3	815	.1														
14	4715	.7	8394	1.3														
15	9159	1.4	4801	.8	1131	.2	887	.1										
16	837	.1	3372	.5														
17	2106	.3																
18																		
19																		
20																		
21																		
22																		
23																		
City																		
Country																	2965	.5
Summer																		
Ycoo																		
NR																		
1							1049	.2										
2																		
3			1107	.2			1067	.2										
4					3156	.5	4445	.7										
5					2087	.3												
6					2493	.4												
7			5298	.8	4859	.8												
8	1844	.3	742	.1	7148	1.1												
9			5469	.9	1173	.2												
10	11227	1.8	7720	1.2	2181	.3												
11	4791	.8	7826	1.2			921	.1										
12	4675	.7																
13	10843	1.7	757	.1														
14	3092	.5	6294	1.0														
15	7881	1.2	5202	.8	1171	.2	857	.1										
16	1030	.2	2291	.4														
17	1934	.3																
18																		
19																		
20																		
21																		
22																		
23																		
City															1104	.2		
Country																	2564	.4

Tabel A2: Home

	X-coordinate																			
	NR		1		2		3		4		5		6		7		8		9	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ycoo																				
NR																				
1																				
2																				
3																				
4																				
5																	874	.1		
6																				
7																				
8																				
9																				
10																			994	.2
11																				
12					2131	.3											1020	.2	9114	1.4
13																	1174	.2	5778	.9
14																	7943	1.3	21130	3.3
15																	4505	.7	19483	3.1
16																	1596	.3	7746	1.2
17															4029	.6			1877	.3
18													3611	.6	8931	1.4	7500	1.2	1699	.3
19									2480	.4			10733	1.7	9634	1.5	21320	3.4		
20							2434	.4			8921	1.4	4744	.7	16634	2.6	17529	2.8	6364	1.0
21							1425	.2	869	.1	10048	1.6	21079	3.3	23428	3.7	37579	5.9		
22					2330	.4					12031	1.9	12908	2.0	12355	2.0			2205	.3
23									4878	.8			2121	.3	1752	.3				
City																				
Country																				

Table A2: cont.

	X-coordinate																	
	10		11		12		13		14		15		16		City		Country	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ycoo																		
NR																		
1							2101	.3										
2																		
3			2265	.4			2003	.3										
4					6296	1.0	9808	1.5										
5					4177	.7												
6					5467	.9												
7			11400	1.8	9842	1.6												
8	3872	.6	1335	.2	15125	2.4												
9			10377	1.6	2505	.4	1040	.2										
10	23968	3.8	19592	3.1	4703	.7												
11	10997	1.7	17053	2.7			1786	.3										
12	10728	1.7			1219	.2												
13	25581	4.0	1572	.2														
14	7807	1.2	14688	2.3														
15	17040	2.7	10003	1.6	2302	.4	1744	.3										
16	1867	.3	5663	.9														
17	4040	.6																
18																		
19																		
20																		
21																		
22																		
23																		
City															1104	.2		
Country																	5529	.9

Table A3: At work

	X-coordinate																			
	NR		1		2		3		4		5		6		7		8		9	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Season																				
Winter																				
Ycoo																				
NR																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8															618	.6				
9													362	.3						
10											287	.3								
11																	723	.7	9124	8.4
12																	300	.3	832	.8
13																	292	.3	1353	1.2
14																	468	.4	1295	1.2
15																			448	.4
16																			356	.3
17																	1002	.9	236	.2
18															847	.8	2670	2.4	587	.5
19													3565	3.3	441	.4	357	.3		
20													434	.4	1411	1.3	2281	2.1		
21											580	.5	8	.0	4737	4.3	413	.4		
22									34	.0	370	.3			3515	3.2	1984	1.8		
23															537	.5				
City																				
Country																				
Summer																				
Ycoo																				
NR																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8															519	.5				
9																				
10											208	.2								
11																	688	.6	8056	7.4
12																	199	.2	715	.7
13																	237	.2	801	.7
14																	373	.3	1284	1.2
15																			398	.4
16																			285	.3
17																	484	.4	211	.2
18															730	.7	2017	1.8		
19													3842	3.5	641	.6	305	.3		
20													36	.0	1460	1.3	1484	1.4		
21											244	.2	68	.1	4166	3.8	320	.3		
22									10	.0	356	.3			3096	2.8	1552	1.4		
23															415	.4				
City																				
Country																				

Table A3 cont.

	X-coordinate																	
	10		11		12		13		14		15		16		City		Country	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Season																		
Winter																		
Ycoo																		
NR																		
1			608	.6			284	.3										
2																		
3					62	.1												
4							329	.3										
5					1058	1.0												
6					224	.2												
7					842	.8												
8			161	.1														
9					7	.0	494	.5										
10	300	.3	398	.4														
11							75	.1										
12	1671	1.5			379	.3	391	.4										
13	3892	3.6	1245	1.1														
14	2331	2.1	332	.3														
15	13	.0	23	.0														
16	744	.7																
17																		
18																		
19																		
20																		
21																		
22																		
23																		
City															1325	1.2		
Country																	108	.1
Summer																		
Ycoo																		
NR																		
1			676	.6			513	.5										
2																		
3																		
4							235	.2										
5					827	.8												
6					2	.0												
7					603	.6												
8			79	.1														
9					5	.0	213	.2										
10	246	.2	472	.4														
11							46	.0										
12	1253	1.1			371	.3	449	.4										
13	2721	2.5	605	.6														
14	2106	1.9	321	.3														
15	24	.0	157	.1														
16	684	.6																
17			12	.0														
18																		
19																		
20																		
21																		
22																		
23																		
City															1138	1.0		
Country																	421	.4

Table A4: At work

	X-coordinate																			
	NR		1		2		3		4		5		6		7		8		9	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ycoo																				
NR																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8															1137	1.0				
9													362	.3						
10											495	.5								
11																	1411	1.3	17180	15.7
12																	499	.5	1547	1.4
13																	529	.5	2154	2.0
14																	841	.8	2579	2.4
15																			846	.8
16																			641	.6
17																	1486	1.4	447	.4
18															1577	1.4	4687	4.3	587	.5
19													7407	6.8	1082	1.0	662	.6		
20													470	.4	2871	2.6	3765	3.4		
21											824	.8	76	.1	8903	8.2	733	.7		
22									44	.0	726	.7			6611	6.1	3536	3.2		
23															952	.9				
City																				
Country																				

Table A4 cont.

	X-coordinate																	
	10		11		12		13		14		15		16		City		Country	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ycoo																		
NR																		
1			1284	1.2			797	.7										
2																		
3					62	.1												
4							564	.5										
5					1885	1.7												
6					226	.2												
7					1445	1.3												
8			240	.2														
9					12	.0	707	.6										
10	546	.5	870	.8														
11							121	.1										
12	2924	2.7			750	.7	840	.8										
13	6613	6.1	1850	1.7														
14	4437	4.1	653	.6														
15	37	.0	180	.2														
16	1428	1.3																
17			12	.0														
18																		
19																		
20																		
21																		
22																		
23																		
City															2463	2.3		
Country																	529	.5

Table A5: School/day–care center

	X–coordinate																			
	NR		1		2		3		4		5		6		7		8		9	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Season																				
Winter																				
Ycoo																				
NR																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12					104	1.6														
13																			188	2.9
14																			49	.7
15																				
16																				
17																				
18																	14	.2		
19															237	3.6				
20																				
21													147	2.2	523	8.0	4	.1		
22															166	2.5				
23																				
City																				
Country																				
Summer																				
Ycoo																				
NR																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12					113	1.7														
13																			145	2.2
14																			51	.8
15																	5	.1		
16																				
17																				
18																				
19															199	3.0				
20																				
21													139	2.1	344	5.3	4	.1		
22															122	1.9				
23																				
City																				
Country																				

Table A5 cont.

	X-coordinate																	
	10		11		12		13		14		15		16		City		Country	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Season																		
Winter																		
Ycoo																		
NR																		
1																		
2																		
3							111	1.7										
4					13	.2												
5																		
6					375	5.7												
7			15	.2	239	3.6												
8					4	.1												
9																		
10			237	3.6	176	2.7												
11							162	2.5										
12	2	.0																
13			423	6.5														
14	23	.4	216	3.3														
15																		
16	47	.7																
17	338	5.2																
18																		
19																		
20																		
21																		
22																		
23																		
City																		
Country																	5	.1
Summer																		
Ycoo																		
NR																		
1																		
2																		
3																		
4					14	.2												
5																		
6					194	3.0												
7			12	.2	166	2.5												
8					6	.1												
9																		
10			137	2.1	154	2.4												
11	1	.0					143	2.2										
12																		
13			194	3.0														
14	24	.4	225	3.4														
15																		
16	32	.5																
17	308	4.7																
18																		
19																		
20																		
21																		
22																		
23																		
City																		
Country																	2	.0

Table 6: School/day-care center

	X-coordinate																			
	NR		1		2		3		4		5		6		7		8		9	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ycoo																				
NR																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12					217	3.3														
13																			333	5.1
14																			100	1.5
15																	5	.1		
16																				
17																				
18																	14	.2		
19															436	6.7				
20																				
21													286	4.4	867	13.2	8	.1		
22															288	4.4				
23																				
City																				
Country																				

Table A6 cont.

	X-coordinate																			
	10		11		12		13		14		15		16		City		Country	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ycoo																		
NR																		
1																		
2																		
3							111	1.7										
4					27	.4												
5																		
6					569	8.7												
7			27	.4	405	6.2												
8					10	.2												
9																		
10			374	5.7	330	5.0												
11	1	.0					305	4.7										
12	2	.0																
13			617	9.4														
14	47	.7	441	6.7														
15																		
16	79	1.2																
17	646	9.9																
18																		
19																		
20																		
21																		
22																		
23																		
City																		
Country																	7	.1

Table A7: Other

	X-coordinate																			
	NR		1		2		3		4		5		6		7		8		9	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Season																				
Winter																				
Ycoo																				
NR	15693	10.4																		
1																				
2																	3	.0		
3																				
4																				
5																	19	.0		
6																			28	.0
7																	3	.0		
8															56	.0				
9											12	.0	14	.0						
10									7	.0	58	.0	4	.0	6	.0			8	.0
11																	262	.2	192	.1
12					15	.0			5	.0			11	.0	49	.0			86	.1
13																	56	.0	221	.1
14											16	.0			35	.0	277	.2	424	.3
15											2	.0					74	.0	289	.2
16															2	.0	88	.1	288	.2
17									6	.0	99	.1	1	.0	19	.0	159	.1	289	.2
18											30	.0	18	.0	188	.1	1009	.7	209	.1
19					5	.0	50	.0	48	.0	13	.0	1234	.8	1192	.8	360	.2	142	.1
20							478	.3	6	.0	122	.1	30	.0	290	.2	597	.4	62	.0
21					5	.0	8	.0	59	.0	268	.2	358	.2	2945	1.9	537	.4	7	.0
22					53	.0	71	.0	139	.1	252	.2	247	.2	491	.3	193	.1	45	.0
23			38	.0			2	.0	127	.1	73	.0	48	.0	162	.1	4	.0	6	.0
City																				
Country																				
Summer																				
Ycoo																				
NR	15102	10.0																		
1																				
2																				
3																			5	.0
4																				
5																	49	.0		
6																			46	.0
7																				
8															38	.0				
9											24	.0	72	.0						
10											37	.0	30	.0					6	.0
11																	95	.1	178	.1
12					17	.0									4	.0			46	.0
13																	29	.0	585	.4
14											9	.0					230	.2	444	.3
15																	152	.1	228	.2
16											3	.0					134	.1	345	.2
17											67	.0	1	.0	25	.0	65	.0	162	.1
18							5	.0			25	.0	27	.0	269	.2	446	.3	225	.1
19							22	.0	238	.2	5	.0	741	.5	958	.6	224	.1	71	.0
20							385	.3	36	.0	144	.1	99	.1	119	.1	407	.3	52	.0
21									45	.0	401	.3	406	.3	2894	1.9	531	.4	9	.0
22					81	.1	78	.1	193	.1	297	.2	473	.3	595	.4	237	.2	25	.0
23			10	.0			11	.0	108	.1	107	.1	68	.0	266	.2			10	.0
City																				
Country																				

Table A7 cont.

	X-coordinate																	
	10		11		12		13		14		15		16		City		Country	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Season																		
Winter																		
Ycoo																		
NR																		
1			11	.0			27	.0										
2					14	.0												
3	8	.0			34	.0	596	.4			4	.0						
4					213	.1	444	.3										
5					175	.1												
6			58	.0	104	.1												
7			203	.1	555	.4	13	.0										
8	32	.0	49	.0	331	.2			1	.0								
9			35	.0	355	.2	29	.0										
10	264	.2	523	.3	114	.1	71	.0	7	.0								
11	297	.2	262	.2	230	.2	356	.2	7	.0								
12	1249	.8	170	.1	73	.0			2	.0								
13	1974	1.3	271	.2														
14	682	.5	558	.4	7	.0					22	.0						
15	266	.2	226	.1	30	.0												
16	152	.1	74	.0							5	.0						
17	212	.1	223	.1					104	.1								
18	4	.0	1	.0														
19																		
20																		
21	3	.0																
22																		
23									5	.0								
City															12530	8.3		
Country																	11329	7.5
Summer																		
Ycoo																		
NR																		
1			8	.0			38	.0										
2							5	.0	4	.0			36	.0				
3					137	.1	298	.2			117	.1						
4			11	.0	181	.1	576	.4										
5					94	.1			7	.0								
6			18	.0	35	.0			148	.1	51	.0						
7			93	.1	420	.3	4	.0	310	.2								
8	3	.0	189	.1	415	.3	16	.0	130	.1								
9	1	.0	134	.1	526	.3	15	.0										
10	182	.1	168	.1	385	.3	169	.1										
11	218	.1	214	.1	320	.2	267	.2	12	.0								
12	812	.5	615	.4	121	.1	58	.0	2	.0								
13	1582	1.0	226	.1	19	.0												
14	629	.4	288	.2	12	.0					58	.0						
15	238	.2	190	.1	58	.0												
16	145	.1	92	.1														
17	181	.1	213	.1	4	.0			43	.0								
18	11	.0																
19																		
20																		
21	10	.0							2	.0	11	.0						
22																		
23									17	.0	5	.0						
City															26560	17.6		
Country																	16838	11.1

Table A8: Other

	X-coordinate																			
	NR		1		2		3		4		5		6		7		8		9	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ycoo																				
NR	30795	20.4																		
1																				
2																	3	.0		
3																			5	.0
4																				
5																	68	.0		
6																			74	.0
7																	3	.0		
8															94	.1				
9											36	.0	86	.1						
10									7	.0	95	.1	34	.0	6	.0			14	.0
11																	357	.2	370	.2
12					32	.0			5	.0			11	.0	53	.0			132	.1
13																	85	.1	806	.5
14											25	.0			35	.0	507	.3	868	.6
15											2	.0					226	.1	517	.3
16											3	.0			2	.0	222	.1	633	.4
17									6	.0	166	.1	2	.0	44	.0	224	.1	451	.3
18							5	.0			55	.0	45	.0	457	.3	1455	1.0	434	.3
19					5	.0	72	.0	286	.2	18	.0	1975	1.3	2150	1.4	584	.4	213	.1
20							863	.6	42	.0	266	.2	129	.1	409	.3	1004	.7	114	.1
21					5	.0	8	.0	104	.1	669	.4	764	.5	5839	3.9	1068	.7	16	.0
22					134	.1	149	.1	332	.2	549	.4	720	.5	1086	.7	430	.3	70	.0
23			48	.0			13	.0	235	.2	180	.1	116	.1	428	.3	4	.0	16	.0
By Land																				

Table A8 cont.

	X-coordinate																	
	10		11		12		13		14		15		16		City		Country	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ycoo NR																		
1			19	.0			65	.0										
2					14	.0	5	.0	4	.0			36	.0				
3	8	.0			171	.1	894	.6			121	.1						
4			11	.0	394	.3	1020	.7										
5					269	.2			7	.0								
6			76	.1	139	.1			148	.1	51	.0						
7			296	.2	975	.6	17	.0	310	.2								
8	35	.0	238	.2	746	.5	16	.0	131	.1								
9	1	.0	169	.1	881	.6	44	.0										
10	446	.3	691	.5	499	.3	240	.2	7	.0								
11	515	.3	476	.3	550	.4	623	.4	19	.0								
12	2061	1.4	785	.5	194	.1	58	.0	4	.0								
13	3556	2.4	497	.3	19	.0												
14	1311	.9	846	.6	19	.0					80	.1						
15	504	.3	416	.3	88	.1												
16	297	.2	166	.1							5	.0						
17	393	.3	436	.3	4	.0			147	.1								
18	15	.0	1	.0														
19																		
20																		
21	13	.0							2	.0	11	.0						
22																		
23									22	.0	5	.0						
City															39090	25.8		
Country																	28167	18.6

APPENDIX 2

Correlation coefficients between
air contaminants and meteorological parameters

Pearson correlation untransformed data. Winter.
Over diagonal : unweighted.
Under diagonal: weighted.

Weight: by (# of cases)$^{-1}$

	SO_2	NO_x	NO_2	O_3	Part-f	Cl_x	SO_4	NO_3	CO	$Temp._{out}$	RH_{out}
SO_2 mean min max		0.31 0.05 0.73	0.37 0.03 0.84	-0.14 -0.42 0.33	0.35 -0.09 0.77	0.17 -0.24 0.79	0.31 -0.10 0.62	0.10 -0.27 0.53	0.03 -1.0 1.0	-0.13 -0.34 0.19	0.02 -0.13 0.23
NO_x	0.31 0.05 0.73		0.72 0.51 0.94	-0.20 -0.43 0.24	0.32 -0.23 0.65	0.08 -0.23 0.65	0.09 -0.07 0.54	0.18 -0.01 0.72	0.87 -0.69 1.0	0.03 -0.24 0.30	0.15 -0.06 0.35
NO_2	0.37 0.03 0.84	0.72 0.51 0.94		-0.21 -0.64 0.49	0.34 -0.28 0.81	0.11 -0.24 0.41	0.19 0.00 0.74	0.29 -0.15 0.68	0.76 -1.0 1.0	0.12 -0.24 0.43	0.16 -0.08 0.42
O_3	-0.14 -0.42 0.33	-0.20 -0.43 0.24	-0.21 -0.64 0.49		-0.20 -0.67 0.30	0.02 -0.24 0.43	0.08 -0.22 0.54	-0.09 -0.25 0.33	-0.20 -1.0 1.0	-0.092 -0.30 0.17	-0.33 -0.62 -0.05
Part-f	0.35 -0.09 0.77	0.32 -0.16 0.80	0.33 -0.29 0.81	-0.21 -0.67 0.30		0.23 -0.43 0.89	0.26 -0.23 0.69	0.15 -0.13 0.50	0.47 -1.0 1.0	0.04 -0.31 0.32	0.01 -0.26 0.26
Cl_x	0.21 -0.24 0.79	0.11 -0.23 0.65	0.11 -0.24 0.41	-0.03 -0.36 0.43	0.26 -0.43 0.89		0.03 -0.23 0.38	0.03 -0.18 0.41	0.02 -1.0 1.0	0.03 -0.31 0.30	0.05 -0.63 0.25
SO_4	0.32 -0.10 0.62	0.09 -0.06 0.54	0.19 0.00 0.74	0.08 -0.22 0.54	0.26 -0.23 0.69	0.02 -0.23 0.38		0.30 0.04 0.68	-0.04 -1.0 1.0	-0.20 -0.51 0.52	-0.20 -0.41 0.31
NO_3	0.11 -0.27 0.53	0.18 -0.01 0.72	0.30 -0.15 0.68	-0.09 -0.25 0.33	0.15 -0.13 0.50	0.03 -0.18 0.41	0.29 0.09 0.68		0.0 -1.0 1.0	0.27 -0.03 0.53	0.16 -0.02 0.42
CO	0.04 -1.0 1.0	0.86 -0.69 1.0	0.74 -1.0 1.0	-0.19 -1.0 1.0	0.51 -1.0 1.0	-0.01 -1.0 1.0	-0.05 -1.0 1.0	-0.02 -1.0 1.0		0.02 -1.0 1.0	-0.04 -1.0 1.0
$Temp._{out}$	-0.14 -0.34 0.19	0.03 -0.24 0.30	0.12 -0.24 0.43	-0.09 -0.30 0.17	0.03 -0.31 0.32	0.00 -0.31 0.30	-0.21 -0.51 0.52	0.27 -0.03 0.53	-0.02 -1.0 1.0		0.26 -0.01 0.61
RH_{out}	0.02 -0.13 0.23	0.15 -0.06 0.35	0.16 -0.08 0.42	-0.33 -0.62 -0.05	0.01 -0.26 0.26	0.07 -0.63 0.26	-0.21 -0.41 0.31	0.16 -0.02 0.42	-0.01 -1.0 1.0	0.26 -0.01 0.61	

Pearson correlation untransformed data. Summer.
Over diagonal : unweighted.
Under diagonal: weighted.

Weight: by (# of cases)$^{-1}$

	SO_2	NO_x	NO_2	O_3	Part-f	Cl_x	SO_4	NO_3	CO	Temp.$_{out}$	RH_{out}
mean SO_2 min max		0.26 0.00 0.88	0.38 0.08 0.88	-0.07 -0.49 0.91	0.34 -0.01 0.81	0.19 -0.81 0.91	0.17 -0.04 0.68	0.14 -0.05 0.87	0.07 -1.0 1.0	-0.12 -0.45 0.43	0.10 -0.34 0.35
NO_x	0.26 0.00 0.88		0.85 0.71 1.0	-0.12 -0.49 0.82	0.43 0.09 0.88	0.08 -0.23 0.68	0.17 0.02 0.67	0.16 0.02 0.84	0.95 0.14 1.0	-0.06 -0.37 0.27	0.07 -0.15 0.37
NO_2	0.38 0.08 0.88	0.85 0.71 1.0		-0.11 -0.47 0.79	0.49 0.07 0.90	0.12 -0.15 0.53	0.24 0.01 0.71	0.22 0.04 0.82	0.75 -1.0 1.0	-0.10 -0.45 0.40	0.13 -0.13 0.57
O_3	-0.07 -0.49 0.91	-0.12 -0.49 0.82	-0.12 -0.47 0.79		-0.04 -0.72 0.61	-0.05 -0.36 0.49	0.09 -0.23 0.70	0.07 -0.27 0.91	-0.32 -1.0 1.0	0.46 -0.60 0.73	-0.39 -0.67 -0.07
Part-f	0.42 0.09 0.88	0.42 0.09 0.88	0.49 0.07 0.90	-0.04 -0.72 0.61		0.30 -0.27 0.90	0.50 0.06 0.90	0.35 0.06 0.83	0.65 -1.0 1.0	0.02 -0.54 0.64	0.16 -0.27 0.72
Cl_x	0.10 -0.23 0.68	0.12 -0.15 0.53	-0.06 -0.36 0.49	0.30 -0.26 0.90	0.30 -0.26 0.90		0.06 -0.20 0.59	0.02 -0.51 0.39	-0.14 -1.0 1.0	-0.06 -0.44 0.29	0.14 -0.22 0.65
SO_4	0.16 -0.04 0.68	0.19 -0.02 0.67	0.24 0.01 0.71	0.09 -0.23 0.70	0.50 0.06 0.90	0.06 -0.20 0.59		0.46 0.18 0.81	0.03 -1.0 1.0	-0.01 -0.47 0.77	0.30 -0.18 0.87
NO_3	0.14 -0.05 0.87	0.16 0.02 0.84	0.22 0.04 0.82	-0.07 -0.27 0.97	0.35 0.06 0.83	0.03 -0.51 0.39	0.46 0.18 0.81		0.03 -1.0 1.0	-0.12 -0.30 0.46	0.23 -0.31 0.63
CO	0.04 -1.0 1.0	0.94 0.14 1.0	0.74 -1.0 1.0	-0.26 -1.0 1.0	0.63 -1.0 1.0	-0.14 -1.0 1.0	0.06 -1.0 1.0	0.09 -1.0 1.0		0.07 -1.0 1.0	-0.07 -1.0 1.0
Temp.$_{out}$	-0.12 -0.45 0.43	-0.06 -0.37 0.27	-0.09 -0.45 0.40	0.46 -0.60 0.73	0.02 -0.54 0.64	-0.06 -0.44 0.29	-0.01 -0.47 0.77	-0.13 -0.30 0.46	-0.01 -1.0 1.0		-0.53 -0.89 0.56
RH_{out}	0.10	0.07	0.13	-0.39	0.15	0.15	0.30	0.23	-0.01	-0.53	

Spearman Rank correlation untransformed data. Winter.
Over diagonal : unweighted.
Under diagonal: weighted.

Weight: by (# of cases)$^{-1}$

	SO_2	NO_x	NO_2	O_3	Part-f	Cl_x	SO_4	NO_3	CO	$Temp._{out}$	RH_{out}
SO_2 Mean Min Max		0.48 0.05 1.0	0.45 0.01 1.0	-0.22 -0.56 0.82	0.52 -0.04 1.0	0.17 -0.28 0.52	0.38 -0.02 0.98	0.14 -0.35 0.89	0.01 -1.0 1.0	-0.16 -0.39 0.19	-0.01 -0.27 0.32
NO_x	0.48		0.91 0.78 1.0	-0.39 -0.74 0.82	0.52 -0.22 1.0	0.13 -0.28 0.57	0.21 -0.07 0.98	0.42 0.04 0.90	0.81 -0.87 1.0	0.16 -0.16 0.37	0.29 0.08 0.48
NO_2	0.45 0.01 1.0	0.91 0.78 1.0		-0.34 -0.71 0.83	0.48 -0.17 0.99	0.13 -0.22 0.43	0.22 -0.03 0.98	0.41 -0.07 0.90	0.70 -1.0 1.0	0.20 -0.20 0.47	0.26 0.03 0.58
O_3	-0.22 -0.56 0.82	-0.40 -0.74 0.82	-0.34 -0.71 0.83		-0.15 -0.59 0.82	-0.00 -0.34 0.46	0.09 -0.24 0.81	-0.10 -0.32 0.69	-0.24 -1.0 1.0	-0.14 -0.42 0.12	-0.38 -0.57 -0.05
Part-f	0.52 -0.04 1.0	0.51 -0.22 1.0	0.48 -0.17 0.99	-0.15 -0.59 0.82		0.19 -0.34 0.63	0.33 -0.17 0.98	0.25 -0.14 0.88	0.41 -1.0 1.0	0.04 -0.33 0.39	0.01 -0.22 0.29
Cl_x	0.17 -0.28 0.52	0.13 -0.28 0.57	0.13 -0.22 0.43	-0.00 -0.34 0.46	0.19 -0.34 0.63		0.07 -0.21 0.43	0.09 -0.32 0.42	0.02 -1.0 1.0	0.06 -0.29 0.52	0.06 -0.29 0.27
SO_4	0.39 -0.02 0.98	0.21 -0.07 0.98	0.22 -0.03 0.98	0.09 -0.24 0.81	0.34 -0.17 0.98	0.07 -0.21 0.43		0.35 -0.01 0.91	-0.03 -1.0 1.0	-0.13 -0.42 0.47	-0.13 -0.37 0.39
NO_3	0.14 -0.35 0.89	0.43 0.04 0.90	0.41 -0.07 0.90	-0.10 -0.32 0.69	0.25 -0.14 0.88	0.09 -0.32 0.42	0.35 0.01 0.92		-0.01 -1.0 1.0	0.37 0.07 0.73	0.34 -0.14 0.57
CO	0.01 -1.0 1.0	0.81 -0.87 1.0	0.70 -1.0 1.0	-0.24 -1.0 1.0	0.41 -1.0 1.0	0.02 -1.0 1.0	-0.03 -1.0 1.0	-0.01 -1.0 1.0		0.02 -1.0 1.0	-0.07 -1.0 1.0
$Temp._{out}$	-0.16 -0.39 0.19	0.16 -0.16 0.37	0.19 -0.20 0.47	-0.14 -0.42 0.12	0.03 -0.33 0.39	0.06 -0.29 0.52	-0.14 -0.42 0.47	0.37 0.07 0.73	0.02 -1.0 1.0		0.37 0.02 0.55
RH_{out}	-0.01 -0.27 0.32	0.29 0.08 0.48	0.26 0.03 0.58	-0.39 -0.57 0.05	0.01 -0.22 0.29	0.06 -0.29 0.27	-0.13 -0.37 0.39	0.34 -0.14 0.52	-0.07 -1.0 1.0	0.37 0.02 0.55	

Spearman Rank correlation untransformed data. Summer
Over diagonal : unweighted.
Under diagonal: weighted.

Weight: by (# of cases)$^{-1}$

	SO_2	NO_x	NO_2	O_3	Part-f	Cl_x	SO_4	NO_3	CO	$Temp._{out}$	RH_{out}
SO_2 Mean Min Max		0.70 0.36 1.0	0.70 0.34 1.0	0.01 -0.59 1.0	0.57 0.09 1.0	0.16 -0.87 0.64	0.37 -0.00 0.99	0.39 0.03 0.97	-0.07 -1.0 1.0	-0.13 -0.53 0.60	0.09 -0.42 0.42
NO_x	0.70 0.36 1.0		0.98 0.91 1.0	-0.02 -0.56 1.0	0.61 0.20 1.0	0.13 -0.21 0.48	0.43 0.01 0.99	0.44 0.10 0.96	0.86 -0.07 1.0	-0.16 -0.50 0.57	0.19 -0.13 0.51
NO_2	0.70 0.34 1.0	0.98 0.91 1.0		-0.02 -0.56 1.0	0.61 0.22 1.0	0.14 -0.20 0.45	0.43 0.03 0.99	0.43 0.08 0.96	0.71 -1.0 1.0	-0.17 -0.53 0.59	0.22 -0.12 0.55
O_3	-0.03 -0.59 1.0	-0.03 -0.56 1.0	-0.02 -0.56 1.0		0.16 -0.65 1.0	-0.04 -0.37 0.38	0.19 -0.33 0.99	0.03 -0.38 0.96	-0.39 -1.0 1.0	0.49 -0.60 0.75	-0.44 -0.73 -0.05
Part-f	0.56 0.09 1.0	0.61 0.20 1.0	0.61 0.21 1.0	0.16 -0.65 1.0		0.28 -0.36 0.70	0.60 0.08 0.99	0.46 0.17 0.98	0.60 -1.0 1.0	0.05 -0.51 0.66	0.18 -0.24 0.64
Cl_x	0.16 -0.87 0.64	0.13 -0.21 0.48	0.14 -0.20 0.45	-0.04 -0.37 -0.38	0.27 -0.36 0.70		0.08 -0.29 0.64	0.04 -0.32 0.29	-0.16 -1.0 1.0	-0.05 -0.40 0.34	0.13 -0.27 0.64
SO_4	0.37 -0.00 0.99	0.42 0.01 0.99	0.43 0.03 0.99	0.19 -0.33 0.99	0.60 0.08 0.99	0.07 -0.29 0.64		0.61 0.38 1.0	0.00 -1.0 1.0	0.01 -0.59 0.55	0.36 -0.65 0.75
NO_3	0.39 0.03 0.97	0.44 0.10 0.96	0.43 0.08 0.96	0.03 -0.38 0.96	0.45 0.17 0.98	0.04 -0.32 0.29	0.61 0.38 1.0		-0.01 -1.0 1.0	-0.14 -0.52 0.54	0.19 -0.54 0.63
CO	-0.07 -1.0 1.0	0.86 -0.07 1.0	0.71 -1.0 1.0	-0.38 -1.0 1.0	0.59 -1.0 1.0	-0.14 -1.0 1.0	0.00 -1.0 1.0	-0.01 -1.0 1.0		0.07 -1.0 1.0	-0.07 -1.0 1.0
$Temp._{out}$	-0.13 -0.53 0.60	-0.16 -0.51 0.57	-0.17 -0.53 0.59	0.49 -0.60 0.75	0.05 -0.51 0.66	-0.05 -0.40 0.34	0.02 -0.59 0.55	-0.14 -0.52 0.54	0.07 -1.0 1.0		-0.54 -0.89 0.30
RH_{out}	0.09 -0.42 0.42	0.19 -0.13 0.51	0.22 -0.12 0.55	-0.44 -0.73 -0.05	0.18 -0.24 0.64	0.13 -0.27 0.64	0.35 -0.65 0.75	0.19 -0.54 0.63	-0.08 -1.0 1.0	-0.54 -0.89 0.30	

APPENDIX 3

Exposure to each air pollution contaminant
in each square kilometer zone

Table C1: Sulfur dioxide (µg/m³)

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
Y-coordinate																			
Not relevant																			
Median	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	30795																		
Mean	10.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	12.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																			
Median	.	.	.	.	.	.	.	.	.	.	.	6.0	.	6.0	.	.	.	.	.
Valid N												1303		2963					
Mean	.	.	.	.	.	.	.	.	.	.	.	6.6	.	6.5	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	4.3	.	4.4	.	.	.	.	.
2																			
Median	.	.	.	.	.	.	.	.	5.0	.	.	.	7.5	.5	2.5	.	1.0	.	.
Valid N									3				14	5	4		36		
Mean	.	.	.	.	.	.	.	.	5.3	.	.	.	8.1	.5	2.6	.	2.2	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.6	.	.	.	2.4		1.9	.	2.3	.	.
3																			
Median	.	.	.	.	.	.	.	.	.	8.0	5.0	6.0	7.0	7.0	.	1.0	.	.	.
Valid N										5	8	2265	233	3008		121			
Mean	.	.	.	.	.	.	.	.	.	6.6	5.6	7.2	8.1	7.3	.	2.0	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	3.4	1.9	5.1	5.0	5.9	.	2.4	.	.	.
4																			
Median	.	.	.	.	.	.	.	.	.	.	.	2.0	7.0	7.0	.	.	.	.	.
Valid N												11	6717	11392					
Mean	.	.	.	.	.	.	.	.	.	.	.	2.4	8.3	7.8	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	1.5	6.4	5.1	.	.	.	.	.
5																			
Median	.	.	.	.	.	.	.	.	7.0	.	.	.	8.0	.	5.0	.	.	.	.
Valid N									942				6331		7				
Mean	.	.	.	.	.	.	.	.	8.3	.	.	.	9.0	.	3.9	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	4.1	.	.	.	6.2	.	1.9	.	.	.	.
6																			
Median	.	.	.	.	.	.	.	.	.	7.0	.	6.0	7.0	.	2.0	2.0	.	.	.
Valid N										74		76	6401		148	51			
Mean	.	.	.	.	.	.	.	.	.	7.7	.	7.3	8.2	.	3.6	2.3	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	5.6	.	5.4	6.7	.	4.2	2.0	.	.	.
7																			
Median	.	.	.	.	.	.	.	.	15.0	.	.	7.0	7.0	9.0	2.0	.	.	.	.
Valid N									3			11723	12667	17	310				
Mean	.	.	.	.	.	.	.	.	14.3	.	.	7.8	8.0	7.3	3.3	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	3.1	.	.	5.9	5.5	4.3	4.1	.	.	.	.
8																			
Median	.	.	.	.	.	.	.	7.0	.	.	7.0	7.0	7.0	4.0	2.0	.	.	.	.
Valid N								1231			3907	1813	15881	16	131				
Mean	.	.	.	.	.	.	.	7.6	.	.	8.0	7.5	7.9	4.1	2.9	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	5.4	.	.	4.4	4.3	5.0	2.3	2.3	.	.	.	.
9																			
Median	.	.	.	.	.	5.0	7.5	.	.	.	6.0	7.0	7.0	8.0	.	.	.	.	.
Valid N						36	448				1	10546	3398	1791					
Mean	.	.	.	.	.	4.9	8.9	.	.	.	6.0	7.5	7.4	8.4	.	.	.	.	.
Std. Dev.	.	.	.	.	.	2.4	6.9	.	.	.		4.7	5.4	5.1	.	.	.	.	.
10																			
Median	.	.	.	.	8.0	7.0	6.0	10.0	.	9.0	8.0	7.0	7.0	6.0	5.0	.	.	.	.
Valid N					7	590	34	6		1008	24960	21527	5532	240	7				
Mean	.	.	.	.	16.3	7.7	7.4	11.2	.	10.0	8.4	8.4	7.8	6.3	6.3	.	.	.	.
Std. Dev.	.	.	.	.	22.9	3.6	6.5	3.7	.	7.5	4.7	4.9	5.2	4.5	3.0	.	.	.	.

Table C1: cont.

		X-coordinate																		
		Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
11	Median	.	.	.	.	.	.	.	.	9.0	8.0	8.0	7.0	6.0	7.0	5.0	.	.	.	.
	Valid N									1768	17550	11513	17529	550	2835	19				
	Mean	.	.	.	.	.	.	.	.	12.0	9.8	8.8	8.1	7.1	7.7	6.0	.	.	.	.
	Std. Dev.	.	.	.	.	.	.	.	.	10.7	6.1	5.5	5.9	5.7	4.2	2.6	.	.	.	.
12	Median	.	.	6.0	.	6.0	.	8.0	10.0	9.0	8.0	7.0	6.0	8.0	6.0	.8	.	.	.	.
	Valid N			2380		5		11	53	1519	10793	15715	785	2163	898	4				
	Mean	.	.	6.8	.	8.2	.	10.9	13.2	10.8	9.2	8.4	6.9	8.7	6.5	1.0	.	.	.	.
	Std. Dev.	.	.	4.4	.	4.4	.	5.9	10.7	9.1	7.1	5.4	3.9	4.0	3.9	.7	.	.	.	.
13	Median	.	.	.	.	.	.	.	.	9.0	7.0	8.0	8.0	2.0	.	.	.	.	.	.
	Valid N									1788	9071	35750	4536	19						
	Mean	.	.	.	.	.	.	.	.	10.2	8.1	8.5	8.3	3.2	.	.	.	.	.	.
	Std. Dev.	.	.	.	.	.	.	.	.	6.8	5.3	4.7	4.4	2.4	.	.	.	.	.	.
14	Median	.	.	.	.	.	6.0	.	12.0	8.0	8.0	8.0	7.0	8.0	.	.	2.0	.	.	.
	Valid N						25		35	9291	24677	13602	16628	19			80			
	Mean	.	.	.	.	.	8.5	.	10.8	9.2	8.7	8.6	7.9	8.2	.	.	4.0	.	.	.
	Std. Dev.	.	.	.	.	.	5.0	.	4.0	5.9	4.3	4.4	5.3	2.3	.	.	4.3	.	.	.
15	Median	.	.	.	.	.	5.0	.	.	9.0	8.0	8.0	7.0	7.0	5.0	.	.	.	.	.
	Valid N						2			4736	20846	17581	10599	2390	1744					
	Mean	.	.	.	.	.	5.0	.	.	9.7	9.3	8.6	7.8	7.5	5.9	.	.	.	.	.
	Std. Dev.	.	.	.	.	.		.	.	5.7	5.3	6.1	5.4	3.7	5.0	.	.	.	.	.
16	Median	.	.	.	.	.	7.0	.	7.0	8.0	8.0	7.0	7.0	.	.	.	10.0	.	.	.
	Valid N						3		2	1818	9020	3671	5829				5			
	Mean	.	.	.	.	.	6.7	.	7.0	9.6	9.2	8.5	8.0	.	.	.	9.2	.	.	.
	Std. Dev.	.	.	.	.	.	1.5	.	1.4	5.0	6.5	6.7	6.1	.	.	.	2.6	.	.	.
17	Median	.	.	.	.	8.5	7.0	10.0	7.0	10.0	10.0	8.0	6.0	8.0	.	4.0	.	.	.	.
	Valid N					6	166	2	4073	1710	2775	5079	448	4		147				
	Mean	.	.	.	.	12.3	8.3	10.0	8.8	11.1	10.7	8.6	7.2	7.8	.	4.7	.	.	.	.
	Std. Dev.	.	.	.	.	11.2	4.7	4.2	9.5	6.5	7.0	5.3	4.9	2.2	.	4.9	.	.	.	.
18	Median	.	.	.	8.0	.	7.0	7.0	8.0	9.0	9.0	9.0	6.0	.	.	.	.	.	.	.
	Valid N				5		55	3656	10965	13656	2720	15	1							
	Mean	.	.	.	8.8	.	7.6	8.7	10.3	11.4	10.4	12.3	6.0	.	.	.	.	.	.	.
	Std. Dev.	.	.	.	2.3	.	3.6	9.1	13.4	12.2	7.1	11.4		.	.	.	.	.	.	.
19	Median	.	.	5.0	8.0	7.0	6.0	8.0	9.0	9.0	8.0	.	.	.	.	.	.	.	.	.
	Valid N			5	72	2766	18	20115	13302	22566	213									
	Mean	.	.	5.0	8.7	7.9	7.7	9.7	11.9	12.2	12.2	.	.	.	.	.	.	.	.	.
	Std. Dev.	.	.		4.0	3.9	3.9	14.6	18.7	14.1	14.9	.	.	.	.	.	.	.	.	.
20	Median	.	.	.	6.0	5.0	7.0	8.0	9.0	12.0	8.0	.	.	.	.	.	.	.	.	.
	Valid N				3297	42	9187	5343	19914	22298	6478									
	Mean	.	.	.	6.4	5.5	8.0	10.0	12.5	18.0	14.3	.	.	.	.	.	.	.	.	.
	Std. Dev.	.	.	.	5.3	4.6	7.2	6.9	16.1	25.4	37.9	.	.	.	.	.	.	.	.	.

Table C1: cont.

	X-coordinate																	
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
21																			
Median	.	.	10.0	6.0	7.0	7.0	8.0	9.0	8.0	7.0	8.0	.	.	.	3.0	1.0	.	.	.
Valid N			5	1433	973	11541	22205	39037	39388	16	13				2	11			
Mean	.	.	9.8	7.3	8.9	8.4	9.6	13.0	11.6	9.0	8.2	.	.	.	3.0	3.3	.	.	.
Std. Dev.	.	.	.8	5.7	7.3	7.9	8.1	16.9	30.1	6.3	2.4	.	.	.	1.4	3.4	.	.	.
22																			
Median	.	.	6.0	6.0	6.0	7.0	7.0	9.0	8.0	6.0	.	.	.	.	.	.	.	.	.
Valid N			2464	149	376	13306	13628	20340	3966	2275									
Mean	.	.	7.2	7.5	7.1	7.8	8.8	11.0	9.4	7.2	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	3.8	4.2	5.7	6.5	10.1	13.8	7.1	8.7	.	.	.	.	.	.	.	.	.
23																			
Median	.	6.0	.	7.0	6.0	7.0	6.0	8.0	7.0	5.0	.	.	.	.	5.0	.5	.	.	.
Valid N		48		13	5113	180	2237	3132	4	16					22	5			
Mean	.	8.5	.	6.0	7.0	6.9	7.8	9.1	7.0	5.3	.	.	.	.	4.1	.6	.	.	.
Std. Dev.	.	7.6	.	2.9	5.4	4.4	6.0	6.8	.8	2.0	.	.	.	.	2.9	.2	.	.	.
City																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5	.
Valid N																		42657	
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.7	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.8	.
Country																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5
Valid N																			34232
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.8
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.1

Table C2: Nitrogen dioxide (µg/m³)

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
Y-coordinate																			
Not relevant																			
Median	18.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	30795																		
Mean	24.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	23.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																			
Median	.	.	.	.	.	.	.	.	.	.	.	12.0	.	9.0	.	.	.	.	.
Valid N												1303		2963					
Mean	.	.	.	.	.	.	.	.	.	.	.	11.5	.	10.4	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	7.4	.	8.5	.	.	.	.	.
2																			
Median	.	.	.	.	.	.	.	.	14.0	.	.	.	16.0	2.0	2.0	.	.5	.	.
Valid N									3				14	5	4		36		
Mean	.	.	.	.	.	.	.	.	13.7	.	.	.	17.7	1.8	1.9	.	2.8	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.6	.	.	.	3.7	.4	1.3	.	3.8	.	.
3																			
Median	.	.	.	.	.	.	.	.	.	13.0	14.5	13.0	15.0	12.0	.	1.0	.	.	.
Valid N										5	8	2265	233	3008		121			
Mean	.	.	.	.	.	.	.	.	.	11.4	15.3	14.7	17.1	14.0	.	3.6	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	4.4	3.3	9.2	14.6	10.6	.	6.0	.	.	.
4																			
Median	.	.	.	.	.	.	.	.	.	.	.	2.0	14.0	12.0	.	.	.	.	.
Valid N												11	6717	11392					
Mean	.	.	.	.	.	.	.	.	.	.	.	2.0	16.2	13.4	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.6	9.9	9.4	.	.	.	.	.
5																			
Median	.	.	.	.	.	.	.	.	12.0	.	.	.	15.0	.	7.0	.	.	.	.
Valid N									942				6331		7				
Mean	.	.	.	.	.	.	.	.	13.2	.	.	.	17.5	.	6.1	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	10.4	.	.	.	10.9	.	2.7	.	.	.	.
6																			
Median	.	.	.	.	.	.	.	.	.	13.5	.	17.5	14.0	.	3.0	1.0	.	.	.
Valid N										74		76	6401		148	51			
Mean	.	.	.	.	.	.	.	.	.	14.3	.	19.4	16.5	.	6.0	3.0	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	8.3	.	11.5	10.5	.	7.9	3.4	.	.	.
7																			
Median	.	.	.	.	.	.	.	.	27.0	.	.	12.0	13.0	14.0	3.0	.	.	.	.
Valid N									3			11723	12667	17	310				
Mean	.	.	.	.	.	.	.	.	25.7	.	.	13.3	14.7	13.5	5.4	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	4.2	.	.	8.0	8.7	4.8	6.3	.	.	.	.
8																			
Median	.	.	.	.	.	.	.	13.0	.	.	12.0	12.0	13.0	7.0	3.0	.	.	.	.
Valid N								1231			3907	1813	15881	16	131				
Mean	.	.	.	.	.	.	.	14.4	.	.	13.3	13.6	14.0	7.9	4.3	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	8.5	.	.	10.4	9.3	8.1	4.5	4.9	.	.	.	.
9																			
Median	.	.	.	.	.	10.0	18.0	.	.	.	13.0	12.0	13.0	12.0	.	.	.	.	.
Valid N						36	448				1	10546	3398	1791					
Mean	.	.	.	.	.	10.3	20.6	.	.	.	13.0	13.8	14.8	13.0	.	.	.	.	.
Std. Dev.	.	.	.	.	.	6.3	14.4	.	.	.		8.7	9.7	8.0	.	.	.	.	.
10																			
Median	.	.	.	.	13.0	13.0	14.0	17.0	.	15.0	14.0	13.0	12.0	10.0	13.0	.	.	.	.
Valid N					7	590	34	6		1008	24960	21527	5532	240	7				
Mean	.	.	.	.	16.0	13.2	15.5	18.0	.	18.1	17.0	14.8	14.4	11.0	11.6	.	.	.	.
Std. Dev.	.	.	.	.	5.1	4.8	12.7	4.1	.	10.6	10.8	8.7	10.5	7.4	3.6	.	.	.	.

Table C2: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
11 Median	.	.	.	.	.	.	.	.	19.0	16.0	16.0	13.0	13.0	11.0	11.0	.	.	.	.
Valid N									1768	17550	11513	17529	550	2835	19				
Mean	.	.	.	.	.	.	.	.	22.7	18.7	18.9	15.2	13.6	12.6	9.1	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	13.0	11.7	12.4	10.1	9.1	7.9	4.3	.	.	.	.
12 Median	.	.	9.0	.	14.0	.	20.0	18.0	19.0	16.0	14.0	12.0	12.0	11.0	7.0	.	.	.	.
Valid N			2380		5		11	53	1519	10793	15715	785	2163	898	4				
Mean	.	.	11.1	.	15.4	.	28.4	24.6	22.4	18.3	16.4	14.6	13.1	10.6	6.8	.	.	.	.
Std. Dev.	.	.	7.6	.	2.9	.	12.9	17.3	13.0	10.7	10.6	10.9	5.5	6.2	2.2	.	.	.	.
13 Median	.	.	.	.	.	.	.	.	17.0	18.0	15.0	14.0	4.0	.	.	.	.	.	.
Valid N									1788	9071	35750	4536	19						
Mean	.	.	.	.	.	.	.	.	19.2	22.8	18.0	15.4	4.6	.	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	11.4	20.1	13.4	9.3	3.5	.	.	.	.	.	.
14 Median	.	.	.	.	.	12.0	.	15.0	15.0	16.0	15.0	12.0	16.0	.	.	6.0	.	.	.
Valid N						25		35	9291	24677	13602	16628	19			80			
Mean	.	.	.	.	.	12.8	.	17.1	17.4	18.2	18.3	13.9	18.8	.	.	6.8	.	.	.
Std. Dev.	.	.	.	.	.	2.8	.	8.5	10.5	11.0	14.4	9.2	11.8	.	.	5.8	.	.	.
15 Median	.	.	.	.	.	11.0	.	.	14.0	16.0	14.0	12.0	11.0	7.0	.	.	.	.	.
Valid N						2			4736	20846	17581	10599	2390	1744					
Mean	.	.	.	.	.	11.0	.	.	14.9	19.3	16.6	13.3	11.9	8.3	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	7.9	15.9	13.4	8.7	6.7	7.5	.	.	.	.	.
16 Median	.	.	.	.	.	13.0	.	26.5	13.0	15.0	13.0	11.0	.	.	.	18.0	.	.	.
Valid N						3		2	1818	9020	3671	5829				5			
Mean	.	.	.	.	.	12.7	.	26.5	14.4	18.5	15.8	12.7	.	.	.	23.2	.	.	.
Std. Dev.	.	.	.	.	.	2.5	.	9.2	7.2	12.7	10.8	9.9	.	.	.	9.5	.	.	.
17 Median	.	.	.	.	19.0	15.0	26.5	13.0	15.0	15.0	12.0	12.0	22.0	.	6.0	.	.	.	.
Valid N					6	166	2	4073	1710	2775	5079	448	4		147				
Mean	.	.	.	.	20.3	15.5	26.5	14.3	16.7	19.9	13.9	12.2	21.8	.	8.4	.	.	.	.
Std. Dev.	.	.	.	.	6.4	8.5	6.4	9.1	9.1	15.4	9.2	9.4	5.4	.	9.2	.	.	.	.
18 Median	.	.	.	18.0	.	17.0	12.0	14.0	14.0	14.0	16.0	13.0	.	.	.	.	.	.	.
Valid N				5		55	3656	10965	13656	2720	15	1							
Mean	.	.	.	17.6	.	17.2	13.7	15.1	16.4	16.8	19.4	13.0	.	.	.	.	.	.	.
Std. Dev.	.	.	.	5.2	.	7.6	7.8	8.5	10.2	10.6	15.5	.	.	.	.	.	.	.	.
19 Median	.	.	11.0	15.0	11.0	15.0	13.0	14.0	14.0	13.0	.	.	.	.	.	.	.	.	.
Valid N			5	72	2766	18	20115	13302	22566	213									
Mean	.	.	11.0	16.5	12.1	15.2	14.5	16.1	15.9	14.9	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.	5.6	5.9	3.6	7.4	8.8	10.2	7.5	.	.	.	.	.	.	.	.	.
20 Median	.	.	.	10.0	14.0	12.0	14.0	14.0	14.0	12.0	.	.	.	.	.	.	.	.	.
Valid N				3297	42	9187	5343	19914	22298	6478									
Mean	.	.	.	11.2	16.1	13.0	15.2	16.5	16.2	13.4	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.	8.3	10.0	7.7	8.7	9.8	9.9	9.1	.	.	.	.	.	.	.	.	.

Table C2: cont.

	X-coordinate																	
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
21																			
Median	.	.	10.0	9.0	12.0	12.0	14.0	14.0	13.0	8.0	12.0	.	.	.	3.5	1.0	.	.	.
Valid N			5	1433	973	11541	22205	39037	39388	16	13				2	11			
Mean	.	.	10.6	11.3	12.2	13.9	15.3	16.6	13.9	11.8	12.9	.	.	.	3.5	4.0	.	.	.
Std. Dev.	.	.	2.5	7.6	6.8	9.8	9.2	12.8	8.2	7.1	4.2	.	.	.	3.5	4.9	.	.	.
22																			
Median	.	.	9.0	13.0	11.0	11.0	12.0	13.0	13.0	9.0	.	.	.	.	.	.	.	.	.
Valid N			2464	149	376	13306	13628	20340	3966	2275									
Mean	.	.	10.7	12.7	11.2	12.5	13.2	14.3	13.8	10.5	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	6.9	6.6	7.2	9.0	8.8	8.9	7.0	8.0	.	.	.	.	.	.	.	.	.
23																			
Median	.	10.5	.	12.0	9.0	12.5	11.0	12.0	12.0	12.0	.	.	.	.	7.0	.5	.	.	.
Valid N		48		13	5113	180	2237	3132	4	16					22	5			
Mean	.	16.7	.	13.5	10.4	12.0	11.6	13.9	12.0	11.8	.	.	.	.	8.4	.6	.	.	.
Std. Dev.	.	14.4	.	7.1	7.4	5.4	6.6	10.3	.8	6.4	.	.	.	.	6.6	.2	.	.	.
City																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5	.
Valid N																		42657	
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.7	.
Country																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5
Valid N																			34232
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.4

Table C3: Nitrogen monoxide (µg/m³)

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
Y-coordinate																			
Not relevant																			
Median	5.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	30795																		
Mean	34.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	106.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																			
Median	.	.	.	.	.	.	.	.	.	.	.	2.0	.	1.0	.	.	.	.	.
Valid N												1303		2963					
Mean	.	.	.	.	.	.	.	.	.	.	.	5.0	.	3.9	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	10.4	.	10.4	.	.	.	.	.
2																			
Median	.	.	.	.	.	.	.	.	3.0	.	.	.	5.0	.5	1.0	.	.5	.	.
Valid N									3				14	5	4		36		
Mean	.	.	.	.	.	.	.	.	3.5	.	.	.	7.1	.5	.9	.	.9	.	.
Std. Dev.	.	.	.	.	.	.	.	.	3.3	.	.	.	6.4	.	.3	.	.7	.	.
3																			
Median	.	.	.	.	.	.	.	.	.	1.0	2.0	2.0	2.0	2.0	.	.5	.	.	.
Valid N										5	8	2265	233	3008		121			
Mean	.	.	.	.	.	.	.	.	.	1.0	2.3	5.2	26.5	7.2	.	1.4	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.6	1.7	9.8	119.1	19.1	.	4.3	.	.	.
4																			
Median	.	.	.	.	.	.	.	.	.	.	.	.5	2.0	2.0	.	.	.	.	.
Valid N												11	6717	11392					
Mean	.	.	.	.	.	.	.	.	.	.	.	.5	7.3	6.1	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.2	15.0	18.0	.	.	.	.	.
5																			
Median	.	.	.	.	.	.	.	.	2.0	.	.	.	3.0	.	1.0	.	.	.	.
Valid N									942				6331		7				
Mean	.	.	.	.	.	.	.	.	8.8	.	.	.	9.9	.	1.0	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	69.8	.	.	.	29.2	.	.	.	.	.	.
6																			
Median	.	.	.	.	.	.	.	.	.	2.0	.	2.0	2.0	.	1.0	.5	.	.	.
Valid N										74		76	6401		148	51			
Mean	.	.	.	.	.	.	.	.	.	3.0	.	5.2	6.3	.	1.2	.9	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	2.9	.	11.4	15.2	.	1.4	.7	.	.	.
7																			
Median	.	.	.	.	.	.	.	.	3.0	.	.	1.0	2.0	4.0	1.0	.	.	.	.
Valid N									3			11723	12667	17	310				
Mean	.	.	.	.	.	.	.	.	3.0	.	.	3.7	5.4	5.2	1.2	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	1.0	.	.	10.6	19.7	4.5	1.2	.	.	.	.
8																			
Median	.	.	.	.	.	.	.	3.0	.	.	2.0	1.0	2.0	.8	1.0	.	.	.	.
Valid N								1231			3907	1813	15881	16	131				
Mean	.	.	.	.	.	.	.	6.5	.	.	9.8	4.5	5.1	1.3	1.4	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	13.9	.	.	48.4	12.6	20.2	1.1	3.3	.	.	.	.
9																			
Median	.	.	.	.	.	1.0	4.0	.	.	.	.5	2.0	2.0	1.0	.	.	.	.	.
Valid N						36	448				1	10546	3398	1791					
Mean	.	.	.	.	.	3.6	13.2	.	.	.	.5	4.3	6.7	6.1	.	.	.	.	.
Std. Dev.	.	.	.	.	.	11.4	28.4	.	.	.	.	20.1	27.6	31.8	.	.	.	.	.
10																			
Median	.	.	.	.	2.0	2.0	2.0	8.0	.	3.0	2.0	2.0	2.0	2.0	3.0	.	.	.	.
Valid N					7	590	34	6		1008	24960	21527	5532	240	7				
Mean	.	.	.	.	3.1	4.1	6.1	10.5	.	12.5	7.9	6.0	6.6	5.0	4.2	.	.	.	.
Std. Dev.	.	.	.	.	2.5	7.8	19.1	7.4	.	21.9	22.0	14.1	31.5	12.5	3.2	.	.	.	.

Table C3: cont.

	X-coordinate									X-coordinate									
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
11																			
Median	.	.	.	.	.	.	.	.	8.0	5.0	3.0	2.0	1.0	2.0	1.0	.	.	.	.
Valid N									1768	17550	11513	17529	550	2835	19				
Mean	.	.	.	.	.	.	.	.	37.3	24.6	12.1	7.0	5.8	6.1	2.7	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	72.5	60.9	33.3	21.3	17.8	17.7	2.4	.	.	.	.
12																			
Median	.	.	1.0	.	1.0	.	27.0	6.0	7.0	3.0	2.0	1.0	2.0	2.0	1.5	.	.	.	.
Valid N			2380		5		11	53	1519	10793	15715	785	2163	898	4				
Mean	.	.	3.6	.	2.7	.	47.8	50.4	24.5	11.3	9.5	5.7	6.9	4.6	1.5	.	.	.	.
Std. Dev.	.	.	9.8	.	2.6	.	55.6	80.0	51.5	25.6	31.8	21.3	17.1	8.9	.6	.	.	.	.
13																			
Median	.	.	.	.	.	.	.	.	4.0	5.0	3.0	3.0	1.0	.	.	.	.	.	.
Valid N									1788	9071	35750	4536	19						
Mean	.	.	.	.	.	.	.	.	16.6	28.3	16.4	10.8	1.3	.	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	43.1	97.8	59.3	32.6	1.1	.	.	.	.	.	.
14																			
Median	.	.	.	.	.	2.0	.	2.0	3.0	3.0	3.0	2.0	4.0	.	.	1.0	.	.	.
Valid N						25		35	9291	24677	13602	16628	19			80			
Mean	.	.	.	.	.	2.4	.	9.9	8.5	11.9	20.2	6.1	26.7	.	.	1.8	.	.	.
Std. Dev.	.	.	.	.	.	2.6	.	15.1	21.6	29.9	68.8	19.4	72.9	.	.	2.5	.	.	.
15																			
Median	.	.	.	.	.	4.0	.	.	2.0	3.0	2.0	2.0	1.0	1.0	.	.	.	.	.
Valid N						2			4736	20846	17580	10599	2390	1744					
Mean	.	.	.	.	.	4.0	.	.	6.5	16.7	12.5	5.2	4.2	1.8	.	.	.	.	.
Std. Dev.	.	.	.	.	.		.	.	18.5	72.1	50.2	16.5	18.5	3.7	.	.	.	.	.
16																			
Median	.	.	.	.	.	2.0	.	30.5	2.0	3.0	2.0	1.0	.	.	.	8.0	.	.	.
Valid N						3		2	1818	9020	3671	5829				5			
Mean	.	.	.	.	.	2.7	.	30.5	6.7	11.4	9.0	6.4	.	.	.	17.2	.	.	.
Std. Dev.	.	.	.	.	.	1.2	.	7.8	25.8	29.9	30.4	28.4	.	.	.	22.9	.	.	.
17																			
Median	.	.	.	.	4.5	3.0	5.0	2.0	4.0	4.0	2.0	1.0	2.3	.	2.0	.	.	.	.
Valid N					6	166	2	4073	1710	2775	5079	448	4		147				
Mean	.	.	.	.	21.5	7.0	5.0	4.6	15.3	21.1	6.3	6.5	2.5	.	3.2	.	.	.	.
Std. Dev.	.	.	.	.	32.3	14.4	2.8	10.9	41.1	56.1	15.4	41.2	2.3	.	6.8	.	.	.	.
18																			
Median	.	.	.	4.0	.	4.0	2.0	2.0	3.0	3.0	4.0	1.0	.	.	.	.	.	.	.
Valid N				5		55	3656	10965	13656	2720	15	1							
Mean	.	.	.	3.8	.	9.9	4.5	6.7	10.9	9.8	39.0	1.0	.	.	.	.	.	.	.
Std. Dev.	.	.	.	.8	.	18.5	13.7	17.6	35.9	27.4	104.5		.	.	.	.	.	.	.
19																			
Median	.	.	2.0	3.0	1.0	1.0	3.0	3.0	2.0	3.0	.	.	.	.	.	.	.	.	.
Valid N			5	72	2766	18	20115	13302	22566	213									
Mean	.	.	1.6	6.2	4.4	3.2	6.7	8.6	9.9	7.1	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.5	10.7	24.5	3.4	19.5	21.8	37.1	14.5	.	.	.	.	.	.	.	.	.
20																			
Median	.	.	.	1.0	2.0	2.0	2.0	3.0	3.0	2.0	.	.	.	.	.	.	.	.	.
Valid N				3297	42	9187	5343	19914	22298	6478									
Mean	.	.	.	3.1	2.8	4.4	8.6	8.5	9.2	5.2	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.	7.2	2.9	10.7	31.3	21.6	26.3	20.3	.	.	.	.	.	.	.	.	.

Table C3: cont.

	X-coordinate																		X-coordinate
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
21																			
Median	.	.	22.0	1.0	1.0	2.0	2.0	3.0	2.0	1.5	2.0	.	.	.	.8	.5	.	.	.
Valid N	.	.	5	1433	973	11541	22205	39037	39388	16	13	.	.	.	2	11	.	.	.
Mean	.	.	23.6	3.7	4.7	6.6	6.7	13.3	5.9	9.0	2.3	.	.	.	.8	1.0	.	.	.
Std. Dev.	.	.	25.1	10.0	18.5	24.7	19.1	59.0	17.3	14.4	.9	.	.	.	.4	1.0	.	.	.
22																			
Median	.	.	1.0	2.0	2.0	1.0	2.0	3.0	4.0	1.0	.	.	.	.	.	.	.	.	.
Valid N	.	.	2464	149	376	13306	13628	20340	3966	2275	.	.	.	.	.	.	.	.	.
Mean	.	.	2.7	4.0	4.7	4.8	4.6	7.5	8.6	3.5	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	8.1	8.1	11.6	20.6	12.7	27.9	23.8	15.4	.	.	.	.	.	.	.	.	.
23																			
Median	.	3.0	.	2.0	1.0	1.0	1.0	2.0	3.0	.8	.	.	.	.	1.0	.5	.	.	.
Valid N	.	48	.	13	5113	180	2237	3132	4	16	.	.	.	.	22	5	.	.	.
Mean	.	6.9	.	4.3	2.9	2.7	2.9	9.4	3.0	1.1	.	.	.	.	2.4	.5	.	.	.
Std. Dev.	.	10.1	.	5.6	11.3	4.5	8.1	33.3	.8	.8	.	.	.	.	3.4	.	.	.	.
City																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5	.
Valid N	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	42657	.
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.6	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22.0	.
Country																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5
Valid N	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	34232
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.6
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.9

Table C4: Ozone (µg/m³)

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
Y-coordinate Not relevant																			
Median	40.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	30795																		
Mean	47.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	40.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																			
Median	.	.	.	.	.	.	.	.	.	.	.	15.0	.	12.0	.	.	.	.	.
Valid N												1303		2963					
Mean	.	.	.	.	.	.	.	.	.	.	.	35.5	.	31.4	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	41.4	.	40.1	.	.	.	.	.
2																			
Median	.	.	.	.	.	.	.	.	5.0	.	.	.	6.0	35.0	121.5	.	92.0	.	.
Valid N									3				14	5	4		36		
Mean	.	.	.	.	.	.	.	.	5.0	.	.	.	7.0	36.6	122.8	.	91.6	.	.
Std. Dev.	.	.	.	.	.	.	.	.	1.0	.	.	.	5.5	4.8	22.9	.	41.5	.	.
3																			
Median	.	.	.	.	.	.	.	.	.	11.0	14.5	15.0	12.0	12.0	.	98.0	.	.	.
Valid N										5	8	2265	233	3008		121			
Mean	.	.	.	.	.	.	.	.	.	26.4	18.0	27.0	25.2	30.8	.	96.0	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	31.0	14.5	30.6	35.0	38.1	.	33.7	.	.	.
4																			
Median	.	.	.	.	.	.	.	.	.	.	.	96.0	11.0	10.0	.	.	.	.	.
Valid N												11	6717	11392					
Mean	.	.	.	.	.	.	.	.	.	.	.	95.5	27.3	21.8	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	10.7	34.7	30.5	.	.	.	.	.
5																			
Median	.	.	.	.	.	.	.	.	6.0	.	.	.	9.0	.	22.0	.	.	.	.
Valid N									942				6331		7				
Mean	.	.	.	.	.	.	.	.	8.1	.	.	.	23.0	.	52.4	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	12.6	.	.	.	31.0	.	44.4	.	.	.	.
6																			
Median	.	.	.	.	.	.	.	.	.	16.0	.	22.5	16.0	.	89.0	105.0	.	.	.
Valid N										74		76	6401		148	51			
Mean	.	.	.	.	.	.	.	.	.	38.8	.	27.8	29.3	.	81.9	104.5	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	42.6	.	29.5	32.7	.	39.2	20.3	.	.	.
7																			
Median	.	.	.	.	.	.	.	.	.5	.	.	12.0	11.0	8.0	95.0	.	.	.	.
Valid N									3			11723	12667	17	310				
Mean	.	.	.	.	.	.	.	.	.5	.	.	26.6	25.7	29.4	97.8	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.		.	.	32.1	32.2	35.9	29.3	.	.	.	.
8																			
Median	.	.	.	.	.	.	.	14.0	.	.	10.0	12.0	9.0	94.0	95.0	.	.	.	.
Valid N								1231			3907	1813	15881	16	131				
Mean	.	.	.	.	.	.	.	29.4	.	.	21.3	27.5	24.1	95.1	90.8	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	36.1	.	.	31.5	34.3	32.5	10.1	30.7	.	.	.	.
9																			
Median	.	.	.	.	.	14.0	27.0	.	.	.	9.0	12.0	14.0	7.0	.	.	.	.	.
Valid N						36	448				1	10546	3398	1791					
Mean	.	.	.	.	.	35.7	30.7	.	.	.	9.0	29.3	35.5	13.8	.	.	.	.	.
Std. Dev.	.	.	.	.	.	36.5	29.4	.	.	.		35.1	39.8	21.0	.	.	.	.	.
10																			
Median	.	.	.	.	6.0	10.0	73.5	.5	.	4.0	9.0	8.0	11.0	24.0	42.0	.	.	.	.
Valid N					7	590	34	6		1008	24960	21527	5532	240	7				
Mean	.	.	.	.	5.6	14.2	62.5	.8	.	9.5	23.0	20.9	26.6	52.4	36.0	.	.	.	.
Std. Dev.	.	.	.	.	3.7	18.5	31.5	.6	.	14.4	31.8	29.7	33.4	51.5	14.2	.	.	.	.

Table C4: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
11 Median	.	.	.	.	.	.	.	.	5.0	7.0	8.0	10.0	24.5	9.0	35.0	.	.	.	.
Valid N									1768	17550	11513	17529	550	2835	19				
Mean	.	.	.	.	.	.	.	.	15.4	17.4	22.2	26.5	46.5	19.7	50.5	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	25.6	27.0	31.0	34.4	44.6	30.8	51.4	.	.	.	.
12 Median	.	.	10.0	.	4.0	.	.5	4.0	4.0	8.0	9.0	18.0	6.0	15.0	66.5	.	.	.	.
Valid N			2380		5		11	53	1519	10793	15715	785	2163	898	4				
Mean	.	.	27.3	.	3.7	.	.5	16.4	15.5	19.2	22.0	29.6	10.3	35.7	68.0	.	.	.	.
Std. Dev.	.	.	36.2	.	2.1	.	.	26.3	24.6	28.5	30.5	30.5	17.6	41.5	4.1	.	.	.	.
13 Median	.	.	.	.	.	.	.	.	7.0	8.0	8.0	8.0	80.0	.	.	.	.	.	.
Valid N									1788	9071	35750	4536	19						
Mean	.	.	.	.	.	.	.	.	20.0	25.0	20.6	18.4	79.3	.	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	29.6	33.1	30.0	25.9	11.5	.	.	.	.	.	.
14 Median	.	.	.	.	.	9.0	.	.5	11.0	8.0	7.0	12.0	12.0	.	.	88.0	.	.	.
Valid N						25		35	9291	24677	13602	16628	19			80			
Mean	.	.	.	.	.	10.6	.	15.7	26.2	21.2	18.8	26.7	11.4	.	.	66.9	.	.	.
Std. Dev.	.	.	.	.	.	7.9	.	18.6	32.6	30.1	28.3	32.5	7.6	.	.	43.7	.	.	.
15 Median	.	.	.	.	.	11.0	.	.	9.0	9.0	10.0	13.0	10.0	25.0	.	.	.	.	.
Valid N						2			4736	20846	17581	10599	2390	1744					
Mean	.	.	.	.	.	11.0	.	.	22.9	23.4	24.0	27.1	19.6	41.2	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	30.8	31.0	31.2	32.9	29.7	38.6	.	.	.	.	.
16 Median	.	.	.	.	.	9.0	.	24.5	8.0	16.0	13.0	10.0	.	.	.	.5	.	.	.
Valid N						3		2	1818	9020	3671	5829				5			
Mean	.	.	.	.	.	9.0	.	24.5	14.5	31.4	26.1	27.6	.	.	.	.5	.	.	.
Std. Dev.	.	.	.	.	.	1.0	.	14.8	23.2	35.0	32.5	35.0	.	.	.	.	.	.	.
17 Median	.	.	.	.	2.3	15.0	37.0	22.0	6.5	10.0	9.0	12.0	5.5	.	64.0	.	.	.	.
Valid N					6	166	2	4073	1710	2775	5079	448	4		147				
Mean	.	.	.	.	2.8	32.2	37.0	36.4	16.6	25.4	22.8	34.0	24.0	.	60.2	.	.	.	.
Std. Dev.	.	.	.	.	2.5	36.9	38.2	36.2	26.7	33.7	33.1	39.3	38.7	.	32.9	.	.	.	.
18 Median	.	.	.	26.0	.	22.0	11.0	12.0	8.0	8.0	11.0	5.0	.	.	.	.	.	.	.
Valid N				5		55	3656	10965	13656	2720	15	1							
Mean	.	.	.	33.2	.	35.8	25.4	25.9	23.3	21.4	39.3	5.0	.	.	.	.	.	.	.
Std. Dev.	.	.	.	24.8	.	35.1	31.5	31.6	32.1	31.7	56.0	.	.	.	.	.	.	.	.
19 Median	.	.	12.0	6.5	8.5	7.5	11.0	9.0	8.0	7.0	.	.	.	.	.	.	.	.	.
Valid N			5	72	2766	18	20115	13302	22566	213									
Mean	.	.	11.4	25.7	15.3	8.8	23.3	22.8	17.8	18.8	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	1.5	33.7	23.8	9.4	30.3	31.2	26.2	30.5	.	.	.	.	.	.	.	.	.
20 Median	.	.	.	24.0	67.5	14.0	7.0	11.0	9.0	14.0	.	.	.	.	.	.	.	.	.
Valid N				3297	42	9187	5343	19914	22298	6478									
Mean	.	.	.	37.7	65.0	29.6	14.6	25.2	22.4	27.5	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.	36.3	38.1	33.9	24.0	31.3	29.9	31.2	.	.	.	.	.	.	.	.	.

Table C4: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
21																			
Median	.	.	.5	10.0	9.0	12.0	10.0	10.0	10.0	39.0	15.0	.	.	.	86.0	120.0	.	.	.
Valid N			5	1433	973	11541	22205	39037	39388	16	13				2	11			
Mean	.	.	.5	24.9	15.9	26.8	22.1	22.8	23.5	37.8	14.9	.	.	.	86.0	102.7	.	.	.
Std. Dev.	.	.		32.7	19.6	31.6	28.9	29.8	30.3	31.3	7.3	.	.	.		31.8	.	.	.
22																			
Median	.	.	11.0	14.0	19.0	13.0	12.0	12.0	9.0	11.0	.	.	.	.	.	.	.	.	.
Valid N			2464	149	376	13306	13628	20340	3966	2275									
Mean	.	.	20.7	24.7	41.6	27.9	28.6	26.5	23.6	30.3	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	29.8	28.8	41.7	33.2	33.6	32.5	32.7	37.4	.	.	.	.	.	.	.	.	.
23																			
Median	.	37.0	.	80.0	11.0	27.5	12.0	11.0	7.0	26.5	.	.	.	.	25.5	125.0	.	.	.
Valid N		48		13	5113	180	2237	3132	4	16					22	5			
Mean	.	43.5	.	72.9	24.3	47.5	23.5	29.4	7.0	23.1	.	.	.	.	46.1	124.8	.	.	.
Std. Dev.	.	41.3	.	23.7	31.1	44.8	30.4	36.2	3.5	18.4	.	.	.	.	40.0	1.8	.	.	.
City																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5	.
Valid N																		42657	
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.0	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10.2	.
Country																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5
Valid N																			34232
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.3
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10.8

Table C5: Carbon monoxide (mg/m^3)

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
Y-coordinate																			
Not relevant																			
Median		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	30780																		
Mean	.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																			
Median	.	.	.	.	.	.	.	.	.	.	.		.		.	.	.	.	.
Valid N												1303		2963					
Mean	.	.	.	.	.	.	.	.	.	.	.	.0	.	.0	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.1	.	.0	.	.	.	.	.
2																			
Median	.	.	.	.	.	.	.	.		.	.	.				.		.	.
Valid N									3				14	5	4		36		
Mean	.	.	.	.	.	.	.	.		.	.	.				.		.	.
Std. Dev.	.	.	.	.	.	.	.	.		.	.	.				.		.	.
3																			
Median	.	.	.	.	.	.	.	.	.						.		.	.	.
Valid N										5	8	2265	233	3008		121			
Mean	.	.	.	.	.	.	.	.	.				.2	.0	.		.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.				1.2	.2	.		.	.	.
4																			
Median	.	.	.	.	.	.	.	.	.	.	.				.	.	.	.	.
Valid N												11	6717	11392					
Mean	.	.	.	.	.	.	.	.	.	.	.		.0	.0	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.		.1	.2	.	.	.	.	.
5																			
Median	.	.	.	.	.	.	.	.		.	.	.		.		.	.	.	.
Valid N									942				6331		7				
Mean	.	.	.	.	.	.	.	.	.0	.	.	.	.0	.		.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.8	.	.	.	.2	.		.	.	.	.
6																			
Median	.	.	.	.	.	.	.	.	.		.			.			.	.	.
Valid N										74		76	6400		148	51			
Mean	.	.	.	.	.	.	.	.	.		.		.0	.			.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.		.		.1	.			.	.	.
7																			
Median	.	.	.	.	.	.	.	.		.	.					.	.	.	.
Valid N									3			11723	12667	17	310				
Mean	.	.	.	.	.	.	.	.		.	.	.0	.0			.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.		.	.	.1	.2			.	.	.	.
8																			
Median	.	.	.	.	.	.	.		.	.						.	.	.	.
Valid N								1231			3907	1813	15881	16	131				
Mean	.	.	.	.	.	.	.	.0	.	.	.1	.0	.0			.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.0	.	.	.5	.1	.2			.	.	.	.
9																			
Median	.	.	.	.	.			.	.	.					.	.	.	.	.
Valid N						36	448				1	10546	3398	1791					
Mean	.	.	.	.	.	.0	.0	.	.	.		.0	.0	.0	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.2	.2	.	.	.		.2	.3	.4	.	.	.	.	.
10																			
Median	.	.	.	.					.							.	.	.	.
Valid N					7	590	34	6		1008	24959	21527	5532	240	7				
Mean	.	.	.	.			.1		.	.0	.0	.0	.0	.0		.	.	.	.
Std. Dev.	.	.	.	.			.3		.	.1	.2	.1	.3	.1		.	.	.	.

Table C5: cont.

		X-coordinate																	
		Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
11	Median	.	.	.	.	.	.	.	.								.	.	.	.
	Valid N									1768	17550	11513	17529	550	2835	19				
	Mean	.	.	.	.	.	.	.	.	.1	.1	.0	.0	.0	.0		.	.	.	.
	Std. Dev.	.	.	.	.	.	.	.	.	.5	.6	.2	.1	.0	.2		.	.	.	.
12	Median	.	.		.		.										.	.	.	.
	Valid N			2380		5		11	53	1519	10793	15714	785	2163	898	4				
	Mean	.	.	.0	.		.		.1	.0	.0	.0	.0	.0	.0		.	.	.	.
	Std. Dev.	.	.	.0	.		.		.5	.1	.1	.3	.3	.1	.1		.	.	.	.
13	Median	.	.	.	.	.	.	.	.						.	.	.	.	.	.
	Valid N									1788	9071	35750	4536	19						
	Mean	.	.	.	.	.	.	.	.	.0	.2	.1	.0		.	.	.	.	.	.
	Std. Dev.	.	.	.	.	.	.	.	.	.3	1.2	1.0	.3		.	.	.	.	.	.
14	Median	.	.	.	.	.		.							.	.		.	.	.
	Valid N						25		35	9291	24677	13602	16628	19			80			
	Mean	.	.	.	.	.		.		.0	.0	.2	.0	.2	.	.		.	.	.
	Std. Dev.	.	.	.	.	.		.		.1	.2	1.2	.1	.9	.	.		.	.	.
15	Median	.	.	.	.	.		.	.							.	.	.	.	.
	Valid N						2			4736	20846	17581	10599	2390	1744					
	Mean	.	.	.	.	.		.	.	.0	.1	.1	.0	.0		.	.	.	.	.
	Std. Dev.	.	.	.	.	.		.	.	.1	.9	.7	.1	.2		.	.	.	.	.
16	Median	.	.	.	.	.		.						.	.	.		.	.	.
	Valid N						3		2	1818	9020	3671	5829				5			
	Mean	.	.	.	.	.		.		.0	.0	.0	.0	.	.	.		.	.	.
	Std. Dev.	.	.	.	.	.		.		.3	.2	.2	.3	.	.	.		.	.	.
17	Median	.	.	.	.										.		.	.	.	.
	Valid N					6	166	2	4073	1710	2775	5079	448	4		147				
	Mean	.	.	.	.	.2			.0	.1	.0	.0	.0		.		.	.	.	.
	Std. Dev.	.	.	.	.	.4			.1	.4	.2	.0	.4		.		.	.	.	.
18	Median	.	.	.		.								.	.	.	.	.	.	.
	Valid N				5		55	3656	10965	13656	2720	15	1							
	Mean	.	.	.		.	.0	.0	.0	.0	.0	.3		.	.	.	.	.	.	.
	Std. Dev.	.	.	.		.	.1	.1	.1	.3	.2	1.3		.	.	.	.	.	.	.
19	Median	.	.									.	.	.	.	.	.	.	.	.
	Valid N			5	72	2766	18	20115	13302	22566	213									
	Mean	.	.		.0	.0		.0	.0	.0		.	.	.	.	.	.	.	.	.
	Std. Dev.	.	.		.1	.3		.2	.1	.4		.	.	.	.	.	.	.	.	.
20	Median	.	.	.								.	.	.	.	.	.	.	.	.
	Valid N				3297	42	9187	5343	19914	22298	6478									
	Mean	.	.	.	.0		.0	.0	.0	.0	.0	.	.	.	.	.	.	.	.	.
	Std. Dev.	.	.	.	.0		.1	.3	.1	.2	.2	.	.	.	.	.	.	.	.	.

Table C5: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
21																			
Median	.	.										.	.	.			.	.	.
Valid N			5	1433	973	11540	22205	39037	39388	16	13				2	11			
Mean	.	.		.0	.0	.0	.0	.1	.0			.	.	.			.	.	.
Std. Dev.	.	.		.1	.2	.3	.2	.7	.1			.	.	.			.	.	.
22																			
Median	.	.									.	.	.	.	.	.	.	.	.
Valid N			2464	149	376	13306	13628	20340	3966	2275									
Mean	.	.	.0			.0	.0	.0	.0	.0	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.1			.2	.1	.3	.2	.2	.	.	.	.	.	.	.	.	.
23																			
Median	.		.								.	.	.	.			.	.	.
Valid N		48		13	5113	180	2237	3132	4	16					22	5			
Mean	.		.		.0		.0	.0			.	.	.	.			.	.	.
Std. Dev.	.		.		.1		.1	.3			.	.	.	.			.	.	.
City																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.
Valid N																		1994	
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.2	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	.
Country																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Valid N																			2069
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.1
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.8

Table C6: Total chlorine (µg/m³)

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
Y-coordinate Not relevant																			
Median	.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	30795																		
Mean	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	2.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																			
Median	.	.	.	.	.	.	.	.	.	.	.	.5	.	.5	.	.	.	.	.
Valid N												1303		2963					
Mean	.	.	.	.	.	.	.	.	.	.	.	.7	.	.8	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.7	.	.9	.	.	.	.	.
2																			
Median	.	.	.	.	.	.	.	.	.5	.	.	.	.8	.5	.5	.	.5	.	.
Valid N									3				14	5	4		36		
Mean	.	.	.	.	.	.	.	.	.5	.	.	.	1.1	.5	.5	.	.5	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.8	.	.	.	.1	.	.
3																			
Median	.	.	.	.	.	.	.	.	.	.5	.5	.5	.5	.5	.	.5	.	.	.
Valid N										5	8	2265	233	3008		121			
Mean	.	.	.	.	.	.	.	.	.	.5	.9	1.2	1.0	1.1	.	.5	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	1.2	2.1	1.6	1.6	.	.3	.	.	.
4																			
Median	.	.	.	.	.	.	.	.	.	.	.	.5	.5	.5	.	.	.	.	.
Valid N												11	6717	11392					
Mean	.	.	.	.	.	.	.	.	.	.	.	.5	1.2	1.0	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	1.9	1.6	.	.	.	.	.
5																			
Median	.	.	.	.	.	.	.	.	.5	.	.	.	.5	.	.5	.	.	.	.
Valid N									942				6331		7				
Mean	.	.	.	.	.	.	.	.	2.1	.	.	.	1.0	.	.5	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	3.0	.	.	.	1.7	.	.	.	.	.	.
6																			
Median	.	.	.	.	.	.	.	.	.	.5	.	.5	.5	.	.5	.5	.	.	.
Valid N										74		76	6401		148	51			
Mean	.	.	.	.	.	.	.	.	.	1.4	.	2.3	1.4	.	.6	.5	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	2.2	.	3.6	2.8	.	.4	.	.	.	.
7																			
Median	.	.	.	.	.	.	.	.	.5	.	.	.5	.5	1.0	.5	.	.	.	.
Valid N									3			11723	12667	17	310				
Mean	.	.	.	.	.	.	.	.	.7	.	.	1.5	1.2	1.4	.5	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.3	.	.	3.0	2.4	.9	.1	.	.	.	.
8																			
Median	.	.	.	.	.	.	.	.5	.	.	.5	.5	.5	.5	.5	.	.	.	.
Valid N								1231			3907	1813	15881	16	131				
Mean	.	.	.	.	.	.	.	2.0	.	.	1.5	1.4	1.3	.5	.5	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	4.2	.	.	3.2	2.9	2.8	.	.2	.	.	.	.
9																			
Median	.	.	.	.	.	.5	.5	.	.	.	.5	.5	.5	.5	.	.	.	.	.
Valid N						36	448				1	10546	3398	1791					
Mean	.	.	.	.	.	1.0	3.1	.	.	.	.5	1.5	1.3	1.4	.	.	.	.	.
Std. Dev.	.	.	.	.	.	1.7	5.7	.	.	.	.	3.3	3.3	3.2	.	.	.	.	.
10																			
Median	.	.	.	.	.5	.5	.8	13.0	.	1.0	.5	.5	.5	.5	1.0	.	.	.	.
Valid N					7	590	34	6		1008	24960	21527	5532	240	7				
Mean	.	.	.	.	.9	1.1	1.5	12.5	.	7.2	2.3	1.7	1.1	.7	1.4	.	.	.	.
Std. Dev.	.	.	.	.	.6	1.5	1.8	8.4	.	18.1	6.1	4.6	2.8	.9	1.2	.	.	.	.

Table C6: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
11 Median	.	.	.	.	.	.	.	.	1.0	.5	.5	.5	.5	.5	.5	.	.	.	.
Valid N									1767	17550	11513	17529	550	2835	19				
Mean	.	.	.	.	.	.	.	.	7.7	3.0	2.2	1.4	.9	.8	.5	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	20.3	8.5	6.1	4.1	1.9	2.0		.	.	.	.
12 Median	.	.	.5	.	1.0	.	4.0	2.0	.5	.5	.5	.5	.5	.5	.5	.	.	.	.
Valid N			2380		5		11	53	1519	10793	15715	785	2163	898	4				
Mean	.	.	1.0	.	1.4	.	18.5	13.7	4.9	2.3	1.5	1.1	1.0	.6	.6	.	.	.	.
Std. Dev.	.	.	2.4	.	1.1	.	21.1	23.3	17.1	9.3	5.2	4.1	2.5	1.1	.3	.	.	.	.
13 Median	.	.	.	.	.	.	.	.	.5	.5	.5	.5	.5	.	.	.	.	.	.
Valid N									1788	9071	35750	4536	19						
Mean	.	.	.	.	.	.	.	.	3.7	1.6	1.2	.9	.5	.	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	13.2	5.9	4.7	1.9		.	.	.	.	.	.
14 Median	.	.	.	.	.	.5	.	.5	.5	.5	.5	.5	.5	.	.	.5	.	.	.
Valid N						25		35	9291	24677	13602	16628	19			80			
Mean	.	.	.	.	.	.9	.	2.1	2.2	1.2	1.0	.8	.6	.	.	.6	.	.	.
Std. Dev.	.	.	.	.	.	1.2	.	4.6	8.9	3.5	2.2	2.1	.2	.	.	.4	.	.	.
15 Median	.	.	.	.	.	.5	.	.	.5	.5	.5	.5	.5	.5	.	.	.	.	.
Valid N						2			4736	20846	17581	10599	2390	1744					
Mean	.	.	.	.	.	.5	.	.	1.7	1.1	.9	.7	.6	.5	.	.	.	.	.
Std. Dev.	.	.	.	.	.		.	.	4.6	3.3	1.7	1.2	.6	.3	.	.	.	.	.
16 Median	.	.	.	.	.	.5	.	.5	.5	.5	.5	.5	.	.	.	.5	.	.	.
Valid N						3		2	1818	9020	3671	5829				5			
Mean	.	.	.	.	.	.5	.	.5	1.2	1.1	.8	.7	.	.	.	1.1	.	.	.
Std. Dev.	.	.	.	.	.		.		2.8	2.5	1.2	.7	.	.	.	1.1	.	.	.
17 Median	.	.	.	.	.5	1.0	1.5	.5	.5	.5	.5	.5	.5	.	.5	.	.	.	.
Valid N					6	166	2	4073	1710	2775	5079	448	4		147				
Mean	.	.	.	.	.6	1.6	1.5	1.4	1.2	1.1	.7	.6	.5	.	.6	.	.	.	.
Std. Dev.	.	.	.	.	.2	2.7	.7	3.2	2.7	2.7	.9	.4		.	.4	.	.	.	.
18 Median	.	.	.	1.0	.	1.0	.5	.5	.5	.5	.5	.5	.	.	.	.	.	.	.
Valid N				5		55	3656	10965	13656	2720	15	1							
Mean	.	.	.	1.0	.	1.1	1.1	1.2	1.0	.8	.7	.5	.	.	.	.	.	.	.
Std. Dev.	.	.	.	.6	.	.9	1.9	2.3	2.1	1.0	.6		.	.	.	.	.	.	.
19 Median	.	.	.5	.5	.5	.5	.5	.5	.5	.5	.	.	.	.	.	.	.	.	.
Valid N			5	72	2766	18	20115	13302	22566	213									
Mean	.	.	.5	.8	.8	.6	.9	1.0	.9	.7	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.		.8	1.1	.2	1.5	1.8	1.7	.7	.	.	.	.	.	.	.	.	.
20 Median	.	.	.	.5	.5	.5	.5	.5	.5	.5	.	.	.	.	.	.	.	.	.
Valid N				3297	42	9187	5343	19914	22298	6478									
Mean	.	.	.	.9	.7	.9	.8	.9	.8	.7	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.	1.3	.2	1.5	1.2	1.4	1.4	.9	.	.	.	.	.	.	.	.	.

Table C6: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
21																			
Median	.	.	.5	.5	.5	.5	.5	.5	.5	.5	.5	.	.	.	.5	.5	.	.	.
Valid N			5	1433	973	11541	22205	39037	39388	16	13				2	11			
Mean	.	.	.5	.8	1.0	.9	.8	.8	.8	.6	.5	.	.	.	.5	.5	.	.	.
Std. Dev.	.	.		1.1	1.6	1.3	1.1	1.2	1.1	.4		.	.	.			.	.	.
22																			
Median	.	.	.5	.5	.5	.5	.5	.5	.5	.5	.	.	.	.	.	.	.	.	.
Valid N			2464	149	376	13306	13628	20340	3966	2275									
Mean	.	.	.6	.8	.7	.8	.8	.8	.7	.6	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.6	.8	.7	1.0	1.0	1.0	.9	.5	.	.	.	.	.	.	.	.	.
23																			
Median	.	.5	.	.5	.5	.5	.5	.5	.5	.5	.	.	.	.	.5	.5	.	.	.
Valid N		48		13	5113	180	2237	3132	4	16					22	5			
Mean	.	.8	.	.7	.7	.7	.6	.7	.5	.6	.	.	.	.	.5	.5	.	.	.
Std. Dev.	.	.7	.	.2	.8	.6	.5	.7		.4	.	.	.	.			.	.	.
City																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5	.
Valid N																		42657	
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.4	.
Country																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5
Valid N																			34232
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.3

Table C7: Suspended particles, fine fraction (µg/m³)

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
Y-coordinate																			
Not relevant																			
Median	12.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	30795																		
Mean	16.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	14.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																			
Median	.	.	.	.	.	.	.	.	.	.	.	28.0	.	20.0	.	.	.	.	.
Valid N												1303		2963					
Mean	.	.	.	.	.	.	.	.	.	.	.	40.5	.	22.8	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	38.8	.	16.7	.	.	.	.	.
2																			
Median	.	.	.	.	.	.	.	.	105.0	.	.	.	46.0	.5	10.0	.	9.0	.	.
Valid N									3				14	5	4		36		
Mean	.	.	.	.	.	.	.	.	104.7	.	.	.	56.4	1.0	10.0	.	8.8	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.6	.	.	.	23.1	1.1	2.4	.	4.9	.	.
3																			
Median	.	.	.	.	.	.	.	.	.	50.0	92.5	16.0	31.0	10.0	.	6.0	.	.	.
Valid N										5	8	2265	233	3008		121			
Mean	.	.	.	.	.	.	.	.	.	43.0	80.0	22.2	37.6	21.8	.	9.1	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	20.4	24.2	16.8	32.6	29.1	.	12.3	.	.	.
4																			
Median	.	.	.	.	.	.	.	.	.	.	.	6.0	12.0	11.0	.	.	.	.	.
Valid N												11	6717	11392					
Mean	.	.	.	.	.	.	.	.	.	.	.	5.5	23.0	24.4	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	1.6	29.3	29.8	.	.	.	.	.
5																			
Median	.	.	.	.	.	.	.	.	6.0	.	.	.	14.0	.	45.0	.	.	.	.
Valid N									942				6331		7				
Mean	.	.	.	.	.	.	.	.	13.0	.	.	.	23.9	.	35.1	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	18.5	.	.	.	26.6	.	19.5	.	.	.	.
6																			
Median	.	.	.	.	.	.	.	.	.	51.5	.	11.0	12.0	.	7.0	5.0	.	.	.
Valid N										74		76	6401		148	51			
Mean	.	.	.	.	.	.	.	.	.	54.7	.	16.9	21.2	.	8.9	5.1	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	39.4	.	13.2	26.3	.	7.2	4.0	.	.	.
7																			
Median	.	.	.	.	.	.	.	.	47.0	.	.	12.0	13.0	8.0	6.0	.	.	.	.
Valid N									3			11723	12667	17	310				
Mean	.	.	.	.	.	.	.	.	44.3	.	.	20.5	24.1	10.2	7.4	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	4.6	.	.	22.9	28.8	6.5	5.2	.	.	.	.
8																			
Median	.	.	.	.	.	.	.	27.0	.	.	16.0	8.0	34.0	6.0	5.0	.	.	.	.
Valid N								1231			3907	1813	15881	16	131				
Mean	.	.	.	.	.	.	.	30.3	.	.	32.1	11.2	40.4	6.1	5.4	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	23.7	.	.	32.3	11.9	33.7	2.4	4.5	.	.	.	.
9																			
Median	.	.	.	.	.	14.5	14.0	.	.	.	11.0	19.0	15.0	12.0	.	.	.	.	.
Valid N						36	448				1	10546	3398	1791					
Mean	.	.	.	.	.	20.1	19.3	.	.	.	11.0	32.0	25.6	29.5	.	.	.	.	.
Std. Dev.	.	.	.	.	.	17.5	19.6	.	.	.		31.9	26.3	36.5	.	.	.	.	.
10																			
Median	.	.	.	.	39.0	38.0	20.5	96.0	.	71.0	18.0	16.0	13.0	9.0	4.0	.	.	.	.
Valid N					7	590	34	6		1008	24960	21527	5532	240	7				
Mean	.	.	.	.	31.7	34.5	24.1	99.0	.	70.8	30.3	30.4	18.3	22.9	9.4	.	.	.	.
Std. Dev.	.	.	.	.	20.7	21.8	21.8	34.0	.	44.2	30.6	33.4	16.7	27.5	13.2	.	.	.	.

Table C7: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
11 Median	.	.	.	.	.	.	.	.	40.0	41.0	13.0	16.0	9.0	21.0	3.0	.	.	.	.
Valid N									1768	17550	11513	17529	550	2835	19				
Mean	.	.	.	.	.	.	.	.	52.2	47.2	24.8	33.4	22.4	26.8	9.8	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	50.9	37.4	28.4	35.1	26.3	24.1	12.4	.	.	.	.
12 Median	.	.	19.0	.	40.0	.	92.0	30.0	23.0	27.0	12.0	9.0	10.0	36.0	5.0	.	.	.	.
Valid N			2380		5		11	53	1519	10793	15715	785	2163	898	4				
Mean	.	.	21.3	.	38.0	.	80.9	53.5	51.8	38.9	24.3	15.9	18.0	37.2	6.0	.	.	.	.
Std. Dev.	.	.	16.5	.	5.7	.	27.0	44.3	62.6	39.1	29.7	17.6	20.5	34.4	6.0	.	.	.	.
13 Median	.	.	.	.	.	.	.	.	12.0	19.0	11.0	12.0	4.0	.	.	.	.	.	.
Valid N									1788	9071	35750	4536	19						
Mean	.	.	.	.	.	.	.	.	23.3	34.8	23.9	27.6	6.2	.	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	32.5	35.9	31.2	31.5	5.1	.	.	.	.	.	.
14 Median	.	.	.	.	.	38.0	.	13.0	12.0	12.0	14.0	13.0	21.0	.	.	8.0	.	.	.
Valid N						25		35	9291	24677	13602	16628	19			80			
Mean	.	.	.	.	.	34.0	.	20.1	21.4	24.5	24.7	28.4	42.6	.	.	15.2	.	.	.
Std. Dev.	.	.	.	.	.	17.1	.	20.6	26.8	29.8	27.2	32.3	36.5	.	.	15.0	.	.	.
15 Median	.	.	.	.	.	37.5	.	.	8.0	14.0	9.0	7.0	3.0	4.0	.	.	.	.	.
Valid N						2			4736	20846	17581	10599	2390	1744					
Mean	.	.	.	.	.	37.5	.	.	12.0	28.3	15.0	12.0	5.9	6.1	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.7	.	.	13.8	32.2	16.6	15.0	7.9	6.6	.	.	.	.	.
16 Median	.	.	.	.	.	19.0	.	13.5	25.0	14.0	20.0	5.0	.	.	.	1.0	.	.	.
Valid N						3		2	1818	9020	3671	5829				5			
Mean	.	.	.	.	.	18.0	.	13.5	29.6	24.2	32.3	8.2	.	.	.	9.8	.	.	.
Std. Dev.	.	.	.	.	.	4.6	.	.7	22.7	25.8	31.4	11.4	.	.	.	12.4	.	.	.
17 Median	.	.	.	.	5.0	12.5	16.5	9.0	56.0	12.0	6.0	23.5	11.5	.	5.0	.	.	.	.
Valid N					6	166	2	4073	1710	2775	5079	448	4		147				
Mean	.	.	.	.	6.7	24.9	16.5	13.8	64.6	26.4	10.4	25.3	12.3	.	8.2	.	.	.	.
Std. Dev.	.	.	.	.	6.2	24.7	.7	13.4	38.9	31.9	15.3	18.3	4.2	.	10.0	.	.	.	.
18 Median	.	.	.	51.0	.	17.0	7.0	14.0	19.0	8.0	57.0	101.0	.	.	.	.	.	.	.
Valid N				5		55	3656	10965	13656	2720	15	1							
Mean	.	.	.	41.8	.	25.7	9.0	25.9	35.2	15.3	49.1	101.0	.	.	.	.	.	.	.
Std. Dev.	.	.	.	19.9	.	24.2	9.1	28.8	35.0	22.4	28.9		.	.	.	.	.	.	.
19 Median	.	.	4.0	39.0	12.0	98.5	11.0	12.0	10.0	40.0	.	.	.	.	.	.	.	.	.
Valid N			5	72	2766	18	20115	13302	22566	213									
Mean	.	.	4.0	40.6	16.9	82.2	21.7	22.4	21.8	33.1	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.7	32.4	16.9	29.8	26.7	26.4	28.7	20.3	.	.	.	.	.	.	.	.	.
20 Median	.	.	.	13.0	11.5	13.0	18.0	11.0	14.0	6.0	.	.	.	.	.	.	.	.	.
Valid N				3297	42	9187	5343	19914	22298	6478									
Mean	.	.	.	24.5	26.7	26.4	32.5	19.8	24.6	8.8	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.	27.6	30.5	29.9	34.4	24.3	26.6	9.9	.	.	.	.	.	.	.	.	.

Table C7: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
21																			
Median	.	.	37.0	4.0	5.0	12.0	13.0	13.0	8.0	9.5	6.0	.	.	.	6.5	6.0	.	.	.
Valid N			5	1433	973	11541	22205	39037	39388	16	13				2	11			
Mean	.	.	34.2	7.3	9.6	21.2	25.0	24.0	15.6	33.2	9.7	.	.	.	6.5	5.0	.	.	.
Std. Dev.	.	.	4.1	10.9	11.6	23.7	27.6	26.3	21.8	47.1	7.1	.	.	.	2.1	3.4	.	.	.
22																			
Median	.	.	2.0	34.0	10.0	8.0	9.0	14.0	42.0	3.0	.	.	.	.	.	.	.	.	.
Valid N			2464	149	376	13306	13628	20340	3966	2275									
Mean	.	.	6.4	39.4	27.4	19.9	15.8	26.4	49.5	6.9	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	11.3	36.8	34.0	28.5	19.5	29.1	39.5	10.9	.	.	.	.	.	.	.	.	.
23																			
Median	.	10.5	.	7.0	5.0	12.0	19.0	9.0	79.5	6.5	.	.	.	.	9.5	6.0	.	.	.
Valid N		48		13	5113	180	2237	3132	4	16					22	5			
Mean	.	13.9	.	7.4	9.6	19.9	20.9	21.0	79.3	21.3	.	.	.	.	17.9	6.2	.	.	.
Std. Dev.	.	13.5	.	3.8	14.9	16.0	15.6	30.0	26.9	28.6	.	.	.	.	18.7	.4	.	.	.
City																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5	.
Valid N																		42657	
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.9	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3.2	.
Country																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5
Valid N																			34232
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3.2

Table C8: Nitrate (μg/m³)

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
Y-coordinate																			
Not relevant																			
Median	.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	30795	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mean	.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																			
Median	.	.	.	.	.	.	.	.	.	.	.	1.0	.	.5	.	.	.	.	.
Valid N	.	.	.	.	.	.	.	.	.	.	.	1303	.	2963	.	.	.	.	.
Mean	.	.	.	.	.	.	.	.	.	.	.	.9	.	.9	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.6	.	.6	.	.	.	.	.
2																			
Median	.	.	.	.	.	.	.	.	1.0	.	.	.	.5	.5	2.0	.	2.0	.	.
Valid N	.	.	.	.	.	.	.	.	3	.	.	.	14	5	4	.	36	.	.
Mean	.	.	.	.	.	.	.	.	1.0	.	.	.	.7	.5	1.6	.	1.5	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.2	.	.8	.	.7	.	.
3																			
Median	.	.	.	.	.	.	.	.	.	.5	.5	.5	1.0	.5	.	.5	.	.	.
Valid N	.	.	.	.	.	.	.	.	.	5	8	2265	233	3008	.	121	.	.	.
Mean	.	.	.	.	.	.	.	.	.	.5	.7	.9	.8	.8	.	.6	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.3	.6	.5	.6	.	.5	.	.	.
4																			
Median	.	.	.	.	.	.	.	.	.	.	.	.5	.5	.5	.	.	.	.	.
Valid N	.	.	.	.	.	.	.	.	.	.	.	11	6717	11392	.	.	.	.	.
Mean	.	.	.	.	.	.	.	.	.	.	.	.5	.8	.8	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.6	.7	.	.	.	.	.
5																			
Median	.	.	.	.	.	.	.	.	.5	.	.	.	.5	.	1.0	.	.	.	.
Valid N	.	.	.	.	.	.	.	.	942	.	.	.	6331	.	7	.	.	.	.
Mean	.	.	.	.	.	.	.	.	.7	.	.	.	.8	.	.9	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.5	.	.	.	.6	.	.2	.	.	.	.
6																			
Median	.	.	.	.	.	.	.	.	.	.5	.	1.0	.5	.	1.0	.5	.	.	.
Valid N	.	.	.	.	.	.	.	.	.	74	.	76	6401	.	148	51	.	.	.
Mean	.	.	.	.	.	.	.	.	.	1.1	.	.9	.9	.	1.0	.6	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.9	.	.6	.7	.	.7	.2	.	.	.
7																			
Median	.	.	.	.	.	.	.	.	2.0	.	.	.5	.5	1.0	.5	.	.	.	.
Valid N	.	.	.	.	.	.	.	.	3	.	.	11723	12667	17	310	.	.	.	.
Mean	.	.	.	.	.	.	.	.	2.0	.	.	.8	.8	1.2	.7	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	1.0	.	.	.8	.7	.6	.4	.	.	.	.
8																			
Median	.	.	.	.	.	.	.	1.0	.	.	.5	.5	.5	.5	.5	.	.	.	.
Valid N	.	.	.	.	.	.	.	1231	.	.	3907	1813	15881	16	131	.	.	.	.
Mean	.	.	.	.	.	.	.	.9	.	.	.9	.8	.8	.7	.6	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.6	.	.	.9	.7	.7	.2	.2	.	.	.	.
9																			
Median	.	.	.	.	.	.5	.5	.	.	.	1.0	.5	.5	.5	.	.	.	.	.
Valid N	.	.	.	.	.	36	448	.	.	.	1	10546	3398	1791	.	.	.	.	.
Mean	.	.	.	.	.	.9	.8	.	.	.	1.0	.8	.9	.8	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.5	.7	.	.	.	.	.8	.7	.6	.	.	.	.	.
10																			
Median	.	.	.	.	.5	1.0	.5	1.0	.	.5	.5	.5	.5	.5	.5	.	.	.	.
Valid N	.	.	.	.	7	590	34	6	.	1008	24960	21527	5532	240	7	.	.	.	.
Mean	.	.	.	.	.5	1.0	.6	.9	.	.9	.8	.8	.9	.8	.5	.	.	.	.
Std. Dev.	.	.	.	.	.	.6	.3	.2	.	.6	.7	.7	.7	.4	.	.	.	.	.

Table C8: cont.

		X-coordinate																		
		Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
11	Median	.	.	.	.	.	.	.	.	1.0	1.0	.5	.5	.5	.5	.5	.	.	.	.
	Valid N									1768	17550	11513	17529	550	2835	19				
	Mean	.	.	.	.	.	.	.	.	.9	.9	.8	.8	.7	.8	.7	.	.	.	.
	Std. Dev.	.	.	.	.	.	.	.	.	.6	.6	.7	.7	.4	.6	.3	.	.	.	.
12	Median	.	.	.5	.	1.0	.	1.0	.5	.5	.5	.5	1.0	.5	1.0	1.0	.	.	.	.
	Valid N			2380		5		11	53	1519	10793	15715	785	2163	898	4				
	Mean	.	.	.8	.	.9	.	1.5	1.0	.9	.9	.8	.9	.8	.9	.9	.	.	.	.
	Std. Dev.	.	.	.7	.	.2	.	.8	.8	.8	.7	.7	.6	.5	.5	.3	.	.	.	.
13	Median	.	.	.	.	.	.	.	.	.5	.5	.5	.8	.5	.	.	.	.	.	.
	Valid N									1788	9071	35750	4536	19						
	Mean	.	.	.	.	.	.	.	.	1.0	.9	.8	.9	.7	.	.	.	.	.	.
	Std. Dev.	.	.	.	.	.	.	.	.	.9	.9	.7	.6	.3	.	.	.	.	.	.
14	Median	.	.	.	.	.	.5	.	.5	.5	.5	.5	.5	1.0	.	.	.5	.	.	.
	Valid N						25		35	9291	24677	13602	16628	19			80			
	Mean	.	.	.	.	.	.8	.	.6	.9	.8	.8	.8	1.0	.	.	.7	.	.	.
	Std. Dev.	.	.	.	.	.	.5	.	.2	.8	.7	.6	.7	.4	.	.	.5	.	.	.
15	Median	.	.	.	.	.	.5	.	.	.5	.5	.5	.5	.5	.5	.	.	.	.	.
	Valid N						2			4736	20846	17581	10599	2390	1744					
	Mean	.	.	.	.	.	.5	.	.	.8	.8	.8	.8	.8	.7	.	.	.	.	.
	Std. Dev.	.	.	.	.	.		.	.	.8	.7	.7	.7	.5	.4	.	.	.	.	.
16	Median	.	.	.	.	.	5.0	.	.5	.5	.5	.5	.5	.	.	.	1.0	.	.	.
	Valid N						3		2	1818	9020	3671	5829				5			
	Mean	.	.	.	.	.	5.0	.	.5	.9	.8	.8	.8	.	.	.	.8	.	.	.
	Std. Dev.	.	.	.	.			.		.9	.7	.6	.6	.	.	.	.3	.	.	.
17	Median	.	.	.	.	1.0	1.0	.8	.5	1.0	.5	.5	.5	1.0	.	.5	.	.	.	.
	Valid N					6	166	2	4073	1710	2775	5079	448	4		147				
	Mean	.	.	.	.	1.0	.8	.8	.8	1.0	.8	.8	.8	1.3	.	.7	.	.	.	.
	Std. Dev.	.	.	.	.		.2	.4	.8	.7	.5	.5	.4	.5	.	.3	.	.	.	.
18	Median	.	.	.	1.0	.	1.0	.5	.5	.5	.5	1.0	.5	.	.	.	.	.	.	.
	Valid N				5		55	3656	10965	13656	2720	15	1							
	Mean	.	.	.	1.2	.	.8	.8	.8	.8	.7	1.0	.5	.	.	.	.	.	.	.
	Std. Dev.	.	.	.	.4	.	.3	.7	.7	.6	.5	.6		.	.	.	.	.	.	.
19	Median	.	.	1.0	1.0	.5	1.0	.5	.5	.5	.5	.	.	.	.	.	.	.	.	.
	Valid N			5	72	2766	18	20115	13302	22566	213									
	Mean	.	.	1.0	.8	.7	.9	.9	.8	.7	.7	.	.	.	.	.	.	.	.	.
	Std. Dev.	.	.		.3	.5	.4	.6	.6	.5	.2	.	.	.	.	.	.	.	.	.
20	Median	.	.	.	.5	.5	.5	.5	.5	.5	.5	.	.	.	.	.	.	.	.	.
	Valid N				3297	42	9187	5343	19914	22298	6478									
	Mean	.	.	.	.8	.7	.8	.8	.8	.8	.7	.	.	.	.	.	.	.	.	.
	Std. Dev.	.	.	.	.7	.2	.6	.5	.6	.5	.5	.	.	.	.	.	.	.	.	.

Table C8: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
21																			
Median	.	.	1.0	.5	.5	.5	.5	.5	.5	.5	1.0	.	.	.	.5	.5	.	.	.
Valid N			5	1433	973	11541	22205	39037	39388	16	13				2	11			
Mean	.	.	.9	.8	.6	.8	.8	.8	.8	.6	.9	.	.	.	.5	.5	.	.	.
Std. Dev.	.	.	.2	.6	.3	.6	.6	.6	.5	.2	.2	.	.	.		.2	.	.	.
22																			
Median	.	.	.5	1.0	.5	.5	.5	.5	1.0	.5	.	.	.	.	.	.	.	.	.
Valid N			2464	149	376	13306	13628	20340	3966	2275									
Mean	.	.	.8	1.0	.8	.8	.7	.8	.9	.7	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.6	.5	.5	.6	.5	.5	.5	.4	.	.	.	.	.	.	.	.	.
23																			
Median	.	1.0	.	.5	.5	.5	.5	.5	.8	1.0	.	.	.	.	.8	.5	.	.	.
Valid N		48		13	5113	180	2237	3132	4	16					22	5			
Mean	.	1.0	.	.7	.8	.9	.8	.8	.8	1.2	.	.	.	.	.8	.5	.	.	.
Std. Dev.	.	.9	.	.3	.6	.7	.5	.5	.3	1.1	.	.	.	.	.3		.	.	.
City																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5	.
Valid N																		42657	
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.1	.
Country																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5
Valid N																			34232
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.1

Table C9: Sulfate (µg/m^3)

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
Y-coordinate Not relevant																			
Median	2.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	30795																		
Mean	3.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																			
Median	.	.	.	.	.	.	.	.	.	.	.	2.0	.	2.0	.	.	.	.	.
Valid N												1303		2963					
Mean	.	.	.	.	.	.	.	.	.	.	.	3.3	.	3.1	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	2.7	.	2.7	.	.	.	.	.
2																			
Median	.	.	.	.	.	.	.	.	3.0	.	.	.	1.5	2.0	5.0	.	5.0	.	.
Valid N									3				14	5	4		36		
Mean	.	.	.	.	.	.	.	.	3.0	.	.	.	1.6	1.8	5.0	.	4.9	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.8	.4	.	.	3.2	.	.
3																			
Median	.	.	.	.	.	.	.	.	.	2.0	2.0	2.0	2.0	2.0	.	2.0	.	.	.
Valid N										5	8	2265	233	3008		121			
Mean	.	.	.	.	.	.	.	.	.	2.0	2.1	3.1	2.8	3.1	.	2.3	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	1.2	2.6	2.0	2.6	.	1.6	.	.	.
4																			
Median	.	.	.	.	.	.	.	.	.	.	.	3.0	2.0	2.0	.	.	.	.	.
Valid N												11	6717	11392					
Mean	.	.	.	.	.	.	.	.	.	.	.	2.8	3.1	3.0	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.6	2.7	2.6	.	.	.	.	.
5																			
Median	.	.	.	.	.	.	.	.	2.0	.	.	.	2.0	.	3.0	.	.	.	.
Valid N									942				6331		7				
Mean	.	.	.	.	.	.	.	.	2.5	.	.	.	3.0	.	4.1	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	2.2	.	.	.	2.6	.	1.5	.	.	.	.
6																			
Median	.	.	.	.	.	.	.	.	.	2.0	.	3.0	2.0	.	2.0	2.0	.	.	.
Valid N										74		76	6401		148	51			
Mean	.	.	.	.	.	.	.	.	.	2.6	.	4.3	3.3	.	2.7	1.9	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	2.6	.	3.7	2.8	.	1.8	1.2	.	.	.
7																			
Median	.	.	.	.	.	.	.	.	7.0	.	.	2.0	2.0	3.0	2.0	.	.	.	.
Valid N									3			11723	12667	17	310				
Mean	.	.	.	.	.	.	.	.	7.0	.	.	3.0	3.1	3.8	2.9	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	1.0	.	.	2.7	2.7	3.1	2.4	.	.	.	.
8																			
Median	.	.	.	.	.	.	.	2.0	.	.	2.0	2.0	2.0	1.0	1.0	.	.	.	.
Valid N								1231			3907	1813	15881	16	131				
Mean	.	.	.	.	.	.	.	3.2	.	.	3.1	3.0	3.0	1.2	1.9	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	2.9	.	.	2.7	2.7	2.6	.5	1.6	.	.	.	.
9																			
Median	.	.	.	.	.	1.0	3.0	.	.	.	2.0	2.0	2.0	2.0	.	.	.	.	.
Valid N						36	448				1	10546	3398	1791					
Mean	.	.	.	.	.	2.4	4.5	.	.	.	2.0	3.1	3.3	3.0	.	.	.	.	.
Std. Dev.	.	.	.	.	.	2.4	3.5	.	.	.	.	2.8	2.8	2.4	.	.	.	.	.
10																			
Median	.	.	.	.	3.0	2.0	3.0	3.0	.	2.0	2.0	2.0	2.0	2.0	1.0	.	.	.	.
Valid N					7	590	34	6		1008	24960	21527	5532	240	7				
Mean	.	.	.	.	2.4	3.1	2.6	2.6	.	3.0	3.0	2.9	3.2	3.1	1.0	.	.	.	.
Std. Dev.	.	.	.	.	1.0	2.3	1.2	1.0	.	2.6	2.7	2.6	2.7	3.3	.	.	.	.	.

Table C9: cont.

		X-coordinate																		
		Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
11	Median	.	.	.	.	.	.	.	.	2.0	2.0	2.0	2.0	2.0	2.0	1.0	.	.	.	.
	Valid N									1768	17550	11513	17529	550	2835	19				
	Mean	.	.	.	.	.	.	.	.	3.4	3.2	2.9	3.0	2.1	2.9	4.3	.	.	.	.
	Std. Dev.	.	.	.	.	.	.	.	.	2.9	2.7	2.7	2.7	1.6	2.5	5.0	.	.	.	.
12	Median	.	.	2.0	.	1.0	.	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	1.5	.	.	.	.
	Valid N			2380		5		11	53	1519	10793	15715	785	2163	898	4				
	Mean	.	.	3.0	.	1.0	.	2.5	3.2	2.9	3.1	3.1	2.9	3.1	3.1	1.5	.	.	.	.
	Std. Dev.	.	.	2.7	.	.	.	.5	1.6	2.7	2.8	2.8	2.6	2.6	3.0	.6	.	.	.	.
13	Median	.	.	.	.	.	.	.	.	2.0	2.0	2.0	2.0	2.0	.	.	.	.	.	.
	Valid N									1788	9071	35750	4536	19						
	Mean	.	.	.	.	.	.	.	.	3.1	3.2	3.0	3.1	2.4	.	.	.	.	.	.
	Std. Dev.	.	.	.	.	.	.	.	.	2.8	3.2	2.8	2.6	2.0	.	.	.	.	.	.
14	Median	.	.	.	.	.	2.0	.	4.0	2.0	2.0	2.0	2.0	1.0	.	.	2.0	.	.	.
	Valid N						25		35	9291	24677	13602	16628	19			80			
	Mean	.	.	.	.	.	2.4	.	3.9	2.9	2.8	2.9	3.2	2.2	.	.	1.9	.	.	.
	Std. Dev.	.	.	.	.	.	1.8	.	2.2	2.7	2.8	2.7	2.9	1.4	.	.	.8	.	.	.
15	Median	.	.	.	.	.	1.0	.	.	2.0	2.0	2.0	2.0	2.0	2.0	.	.	.	.	.
	Valid N						2			4736	20846	17581	10599	2390	1744					
	Mean	.	.	.	.	.	1.0	.	.	2.7	2.9	2.9	3.0	2.8	3.0	.	.	.	.	.
	Std. Dev.	.	.	.	.	.	.	.	.	2.5	2.7	2.7	2.8	2.6	2.7	.	.	.	.	.
16	Median	.	.	.	.	.	6.0	.	4.0	2.0	2.0	2.0	2.0	.	.	.	3.0	.	.	.
	Valid N						3		2	1818	9020	3671	5829				5			
	Mean	.	.	.	.	.	6.0	.	4.0	2.7	3.0	3.0	3.0	.	.	.	2.6	.	.	.
	Std. Dev.	.	.	.	.	.	.	.	.	2.5	2.8	2.8	2.8	.	.	.	.5	.	.	.
17	Median	.	.	.	.	5.0	3.0	3.0	2.0	3.0	2.0	2.0	2.0	6.0	.	2.0	.	.	.	.
	Valid N					6	166	2	4073	1710	2775	5079	448	4		147				
	Mean	.	.	.	.	5.0	2.7	3.0	3.1	3.6	3.1	3.0	2.6	7.0	.	2.7	.	.	.	.
	Std. Dev.	.	.	.	.	.	1.3	2.8	2.7	2.9	2.7	2.8	2.1	2.0	.	1.9	.	.	.	.
18	Median	.	.	.	3.0	.	3.0	2.0	2.0	2.0	2.0	4.0	3.0	.	.	.	.	.	.	.
	Valid N				5		55	3656	10965	13656	2720	15	1							
	Mean	.	.	.	3.0	.	4.0	2.9	3.1	3.0	2.9	3.8	3.0	.	.	.	.	.	.	.
	Std. Dev.	.	.	.	.	.	3.6	2.4	2.7	2.6	2.6	1.9	.	.	.	.	.	.	.	.
19	Median	.	.	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	.	.	.	.	.	.	.	.	.
	Valid N			5	72	2766	18	20115	13302	22566	213									
	Mean	.	.	2.0	2.3	2.5	2.8	3.0	3.1	2.8	2.1	.	.	.	.	.	.	.	.	.
	Std. Dev.	.	.	.	2.0	2.4	2.0	2.6	2.7	2.5	1.7	.	.	.	.	.	.	.	.	.
20	Median	.	.	.	2.0	2.0	2.0	2.0	2.0	2.0	2.0	.	.	.	.	.	.	.	.	.
	Valid N				3297	42	9187	5343	19914	22298	6478									
	Mean	.	.	.	3.1	3.4	2.9	2.7	3.1	3.1	3.0	.	.	.	.	.	.	.	.	.
	Std. Dev.	.	.	.	2.6	3.2	2.6	2.5	2.7	2.7	2.6	.	.	.	.	.	.	.	.	.

Table C9: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
21																			
Median	.	.	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.0	.	.	.	5.0	1.0	.	.	.
Valid N	.	.	5	1433	973	11541	22205	39037	39388	16	13	.	.	.	2	11	.	.	.
Mean	.	.	1.0	2.7	2.9	3.0	3.0	3.1	3.0	2.8	1.8	.	.	.	5.0	1.4	.	.	.
Std. Dev.	.	.		2.2	2.5	2.6	2.6	2.6	2.7	2.3	.4	.	.	.		.5	.	.	.
22																			
Median	.	.	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	.	.	.	.	.	.	.	.	.
Valid N	.	.	2464	149	376	13306	13628	20340	3966	2275	.	.	.	.	.	.	.	.	.
Mean	.	.	2.9	3.4	2.8	3.0	2.9	3.2	3.2	3.0	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	2.5	2.9	2.5	2.6	2.6	2.7	2.7	2.7	.	.	.	.	.	.	.	.	.
23																			
Median	.	3.0	.	2.0	2.0	2.0	2.0	2.0	1.5	3.0	.	.	.	.	4.0	2.0	.	.	.
Valid N	.	48	.	13	5113	180	2237	3132	4	16	.	.	.	.	22	5	.	.	.
Mean	.	4.5	.	1.9	2.9	2.7	2.7	3.3	1.5	3.1	.	.	.	.	4.6	2.0	.	.	.
Std. Dev.	.	3.9	.	1.1	2.4	1.9	2.4	2.7	.6	1.1	.	.	.	.	3.8		.	.	.
City																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5	.
Valid N	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	42657	.
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.6	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.6	.
Country																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.5
Valid N	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	34232
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.6
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.7

Average pollen concentration under various environmental conditions.
Zero recoded as missing

Table C10: Grass pollen (pollen/m^3)

	X-coordinate																
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Y-coordinate																	
Not relevant																	
Median	10.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	3516																
Mean	65.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	143.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																	
Median	.	.	.	.	.	.	.	.	.	.	.	10.0	.	10.0	.	.	.
Valid N												181		396			
Mean	.	.	.	.	.	.	.	.	.	.	.	42.0	.	80.0	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	93.5	.	213.2	.	.	.
2																	
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.0	.	5.0
Valid N															1		8
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.0	.	3.6
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	1.9
3																	
Median	.	.	.	.	.	.	.	.	.	3.0	.	5.0	5.0	10.0	.	10.0	.
Valid N										2		269	12	241		40	
Mean	.	.	.	.	.	.	.	.	.	3.0	.	37.8	5.4	49.6	.	21.5	.
Std. Dev.	.	.	.	.	.	.	.	.	.	2.8	.	101.7	4.0	214.3	.	51.7	.
4																	
Median	.	.	.	.	.	.	.	.	.	.	.	281.0	5.0	5.0	.	.	.
Valid N												11	668	1063			
Mean	.	.	.	.	.	.	.	.	.	.	.	297.9	58.8	44.6	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	271.7	172.6	196.5	.	.	.
5																	
Median	.	.	.	.	.	.	.	.	49.0	.	.	.	7.0	.	.	.	.
Valid N									7				560				
Mean	.	.	.	.	.	.	.	.	39.7	.	.	.	65.4	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	26.2	.	.	.	185.3	.	.	.	.
6																	
Median	.	.	.	.	.	.	.	.	.	1.0	.	38.0	5.0	.	10.0	10.0	.
Valid N										1		3	529		104	3	
Mean	.	.	.	.	.	.	.	.	.	1.0	.	36.3	54.6	.	65.8	9.7	.
Std. Dev.	.	.	.	.	.	.	.	.	.		.	21.5	183.3	.	140.3	4.5	.
7																	
Median	.	.	.	.	.	.	.	.	.	.	.	5.0	5.0	.	10.0	.	.
Valid N												835	1095		129		
Mean	.	.	.	.	.	.	.	.	.	.	.	52.6	68.1	.	66.2	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	182.4	241.1	.	153.9	.	.
8																	
Median	.	.	.	.	.	.	.	10.0	.	.	5.0	5.0	5.0	10.0	10.0	.	.
Valid N								191			292	176	1518	8	70		
Mean	.	.	.	.	.	.	.	64.4	.	.	14.5	81.5	63.4	14.6	113.8	.	.
Std. Dev.	.	.	.	.	.	.	.	135.4	.	.	42.1	269.1	199.0	10.9	184.9	.	.

Table C10: cont.

	X-coordinate																
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
9 Median	.	.	.	.	.	5.0	5.0	.	.	.	.	6.0	10.0	5.0	.	.	.
Valid N						18	21					1189	365	53			
Mean	.	.	.	.	.	20.2	8.3	.	.	.	.	64.2	59.9	116.5	.	.	.
Std. Dev.	.	.	.	.	.	25.6	6.0	.	.	.	.	207.8	134.0	345.2	.	.	.
10 Median	.	.	.	.	.	2.5	5.0	.	.	.	5.0	10.0	10.0	5.0	.	.	.
Valid N						58	6				2267	1842	651	49			
Mean	.	.	.	.	.	22.5	5.0	.	.	.	59.4	67.9	78.3	39.7	.	.	.
Std. Dev.	.	.	.	.	.	38.1	.	.	.	.	194.6	209.6	235.0	125.8	.	.	.
11 Median	.	.	.	.	.	.	.	.	5.0	5.0	5.0	10.0	5.0	4.5	24.0	.	.
Valid N									191	2442	913	1616	66	254	5		
Mean	.	.	.	.	.	.	.	.	31.3	40.9	50.8	60.6	34.2	37.3	18.4	.	.
Std. Dev.	.	.	.	.	.	.	.	.	76.5	99.9	187.1	200.5	127.0	100.2	14.5	.	.
12 Median	.	.	5.0	.	.	.	.	.	10.0	5.0	5.0	5.0	2.0	10.0	.	.	.
Valid N			214						136	1252	1411	187	133	142			
Mean	.	.	25.7	.	.	.	.	.	55.2	57.3	41.5	67.1	21.1	57.2	.	.	.
Std. Dev.	.	.	74.0	.	.	.	.	.	114.1	183.8	163.9	226.7	49.0	121.3	.	.	.
13 Median	.	.	.	.	.	.	.	.	5.0	10.0	5.0	10.0	81.0	.	.	.	.
Valid N									96	925	3372	398	19				
Mean	.	.	.	.	.	.	.	.	13.6	69.2	56.0	78.8	111.9	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	24.8	199.6	187.4	204.6	107.5	.	.	.	.
14 Median	.	.	.	.	.	4.5	.	.	5.0	5.0	5.0	10.0	.	.	.	10.0	.
Valid N						2			1075	2515	1326	1485				5	
Mean	.	.	.	.	.	4.5	.	.	64.5	54.3	51.0	74.6	.	.	.	13.6	.
Std. Dev.	.	.	.	.	.	2.1	.	.	204.4	168.4	156.7	235.7	.	.	.	9.2	.
15 Median	.	.	.	.	.	.	.	.	5.0	5.0	10.0	5.0	5.0	10.0	.	.	.
Valid N									455	2131	1688	1123	302	212			
Mean	.	.	.	.	.	.	.	.	45.6	48.5	75.0	54.1	38.5	86.7	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	158.0	180.6	231.1	169.2	103.4	256.0	.	.	.
16 Median	.	.	.	.	.	1.0	.	.	3.0	10.0	5.0	5.0	.	.	.	.	.
Valid N						1			175	854	395	353					
Mean	.	.	.	.	.	1.0	.	.	15.3	69.2	59.1	8.2	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	46.1	238.1	182.2	8.5	.	.	.	.	.
17 Median	.	.	.	.	.	10.0	10.0	5.0	10.0	5.0	10.0	19.0	.	.	10.0	.	.
Valid N						17	1	345	140	413	528	62			5		
Mean	.	.	.	.	.	39.6	10.0	42.0	77.7	37.2	87.0	124.5	.	.	8.8	.	.
Std. Dev.	.	.	.	.	.	76.8	.	189.2	149.2	92.3	238.2	187.0	.	.	3.8	.	.
18 Median	.	.	.	.	.	10.0	10.0	5.0	5.0	10.0	5.0	.	.	.	.	.	.
Valid N						9	407	1003	1479	192	1						
Mean	.	.	.	.	.	7.3	87.5	61.8	58.2	35.2	5.0	.	.	.	.	.	.
Std. Dev.	.	.	.	.	.	3.4	259.4	211.9	171.3	138.1	.	.	.	.	.	.	.

Table C10: cont.

	X-coordinate																
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
19																	
Median	.	.	.	10.0	3.0	1.0	5.0	10.0	5.0	19.0	.	.	.	.	.	.	.
Valid N				9	135	1	2245	1143	1951	15							
Mean	.	.	.	7.8	15.9	1.0	64.1	65.1	58.4	106.1	.	.	.	.	.	.	.
Std. Dev.	.	.	.	2.6	51.1		184.2	183.1	199.5	144.3	.	.	.	.	.	.	.
20																	
Median	.	.	.	10.0	5.0	5.0	5.0	5.0	5.0	10.0	.	.	.	.	.	.	.
Valid N				394	6	745	353	1811	1859	664							
Mean	.	.	.	83.8	10.5	68.6	40.9	63.5	57.7	78.3	.	.	.	.	.	.	.
Std. Dev.	.	.	.	215.0	9.8	226.8	166.6	215.2	197.8	232.9	.	.	.	.	.	.	.
21																	
Median	.	.	.	5.0	8.0	10.0	5.0	5.0	6.0	33.5	.	.	.	.	.	35.5	.
Valid N				145	8	982	2144	4063	3650	4						2	
Mean	.	.	.	111.9	25.6	63.3	52.2	57.4	64.2	34.5	.	.	.	.	.	35.5	.
Std. Dev.	.	.	.	305.6	34.3	215.4	189.2	181.5	205.9	18.0	.	.	.	.	.	30.4	.
22																	
Median	.	.	4.0	8.5	5.0	10.0	10.0	5.0	10.0	5.0	.	.	.	.	.	.	.
Valid N			264	6	45	1332	1291	2016	463	100							
Mean	.	.	31.9	10.3	79.2	70.4	60.9	51.2	71.2	8.5	.	.	.	.	.	.	.
Std. Dev.	.	.	91.1	9.8	153.1	221.9	207.0	141.0	152.7	9.2	.	.	.	.	.	.	.
23																	
Median	.	5.0	.	497.5	5.0	24.0	5.0	5.0	.	4.0	.	.	.	.	1.0	.	.
Valid N		1		4	487	28	233	385		1					2		
Mean	.	5.0	.	425.0	53.5	146.3	66.1	51.5	.	4.0	.	.	.	.	1.0	.	.
Std. Dev.	.		.	273.0	222.7	214.2	234.7	187.2			.	.	.	.		.	.

Average pollen concentration under various environmental conditions.
Zero recoded as missing

Table C11: Birch pollen (pollen/m^3)

	X-coordinate																
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Y-coordinate																	
Not relevant																	
Median	14.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	5248																
Mean	44.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	61.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																	
Median	.	.	.	.	.	.	.	.	.	.	.	10.0	.	5.0	.	.	.
Valid N												243		512			
Mean	.	.	.	.	.	.	.	.	.	.	.	26.5	.	23.9	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	49.0	.	44.1	.	.	.
2																	
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.0	.	5.0
Valid N															2		8
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.0	.	5.8
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4.4
3																	
Median	.	.	.	.	.	.	.	.	.	1.0	.	6.0	33.5	14.0	.	29.0	.
Valid N										1		371	42	425		63	
Mean	.	.	.	.	.	.	.	.	.	1.0	.	39.3	53.0	44.3	.	103.1	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	84.4	61.0	82.1	.	156.9	.
4																	
Median	.	.	.	.	.	.	.	.	.	.	.	5.0	10.0	5.0	.	.	.
Valid N												1	989	1615			
Mean	.	.	.	.	.	.	.	.	.	.	.	5.0	39.9	27.0	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	78.2	63.6	.	.	.
5																	
Median	.	.	.	.	.	.	.	.	6.0	.	.	.	10.0	.	.	.	.
Valid N									24				897				
Mean	.	.	.	.	.	.	.	.	39.4	.	.	.	27.6	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	77.3	.	.	.	51.3	.	.	.	.
6																	
Median	.	.	.	.	.	.	.	.	.	11.0	.	8.0	10.0	.	5.0	11.0	.
Valid N										35		4	851		42	42	
Mean	.	.	.	.	.	.	.	.	.	44.1	.	7.8	41.1	.	20.9	62.9	.
Std. Dev.	.	.	.	.	.	.	.	.	.	64.7	.	2.1	88.0	.	33.7	89.7	.
7																	
Median	.	.	.	.	.	.	.	.	.	.	.	10.0	10.0	.	38.0	.	.
Valid N												1595	1657		121		
Mean	.	.	.	.	.	.	.	.	.	.	.	41.7	38.5	.	68.0	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	81.1	79.7	.	86.2	.	.
8																	
Median	.	.	.	.	.	.	.	5.0	.	.	6.0	6.0	10.0	7.5	14.0	.	.
Valid N								155			601	305	2274	4	62		
Mean	.	.	.	.	.	.	.	17.2	.	.	18.0	24.1	36.1	8.5	40.2	.	.
Std. Dev.	.	.	.	.	.	.	.	34.3	.	.	31.1	47.4	72.2	4.4	58.0	.	.

Table C11: cont.

						X-coordinate								X-coordinate			
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
9																	
Median	.	.	.	.	.	5.0	14.0	.	.	.	2.0	10.0	14.0	7.0	.	.	.
Valid N						1	15				1	1592	498	77			
Mean	.	.	.	.	.	5.0	25.8	.	.	.	2.0	40.2	48.4	54.8	.	.	.
Std. Dev.	.	.	.	.	.		35.7	.	.	.		84.1	71.3	136.5	.	.	.
10																	
Median	.	.	.	.	.	5.0	5.0	.	.	14.5	10.0	7.0	10.0	14.0	.	.	.
Valid N						98	3			2	3571	2502	794	82			
Mean	.	.	.	.	.	18.2	5.3	.	.	14.5	38.7	27.6	32.1	31.2	.	.	.
Std. Dev.	.	.	.	.	.	25.8	4.5	.	.	6.4	80.7	60.0	74.4	41.4	.	.	.
11																	
Median	.	.	.	.	.	.	.	.	5.0	5.0	10.0	10.0	43.0	5.0	1.0	.	.
Valid N									264	2538	1406	2387	157	438	2		
Mean	.	.	.	.	.	.	.	.	14.4	17.4	35.8	42.9	80.1	24.4	1.0	.	.
Std. Dev.	.	.	.	.	.	.	.	.	28.2	36.3	76.5	86.4	91.8	51.5		.	.
12																	
Median	.	.	8.0	.	.	.	.	26.0	10.0	5.0	10.0	5.0	3.0	5.0	5.0	.	.
Valid N			368					4	170	1466	2005	140	135	159	2		
Mean	.	.	24.0	.	.	.	.	24.8	39.4	24.7	34.9	10.4	22.1	15.1	5.0	.	.
Std. Dev.	.	.	42.7	.	.	.	.	9.7	97.3	60.8	73.8	13.2	58.5	29.2		.	.
13																	
Median	.	.	.	.	.	.	.	.	8.0	10.0	7.0	5.0	5.0	.	.	.	.
Valid N									259	1191	4697	517	1				
Mean	.	.	.	.	.	.	.	.	25.7	33.7	31.7	13.5	5.0	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	49.0	74.7	69.7	26.6		.	.	.	.
14																	
Median	.	.	.	.	.	8.0	.	.	10.0	10.0	5.0	8.0	1.0	.	.	95.0	.
Valid N						3			1326	3403	1738	1847	5			37	
Mean	.	.	.	.	.	7.7	.	.	34.1	35.3	22.5	35.4	1.0	.	.	166.5	.
Std. Dev.	.	.	.	.	.	1.5	.	.	68.2	74.3	46.9	79.8		.	.	175.1	.
15																	
Median	.	.	.	.	.	.	.	.	10.0	8.0	10.0	10.0	5.0	10.0	.	.	.
Valid N									584	2793	2353	1630	379	309			
Mean	.	.	.	.	.	.	.	.	33.5	34.5	37.4	32.9	16.8	42.6	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	59.9	73.6	79.1	69.4	32.3	91.0	.	.	.
16																	
Median	.	.	.	.	.	.	.	.	5.0	14.0	7.0	10.0	.	.	.	.	.
Valid N									282	1422	578	748					
Mean	.	.	.	.	.	.	.	.	21.2	49.4	35.2	42.2	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	45.3	89.9	74.2	86.0	.	.	.	.	.
17																	
Median	.	.	.	.	.	5.0	.	17.0	5.0	5.0	5.0	10.0	1.0	.	5.0	.	.
Valid N						22		667	163	200	647	75	1		23		
Mean	.	.	.	.	.	8.5	.	56.0	13.0	7.4	17.2	24.3	1.0	.	17.6	.	.
Std. Dev.	.	.	.	.	.	6.9	.	94.4	32.5	10.5	37.4	33.5		.	50.1	.	.

Table C11: cont.

	X-coordinate																
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
18																	
Median	.	.	.	1.0	.	5.0	10.0	10.0	7.0	9.0	1.0	.	.	.	.	.	.
Valid N				1		5	444	1562	1747	301	2						
Mean	.	.	.	1.0	.	7.4	44.7	34.0	34.1	32.8	1.0	.	.	.	.	.	.
Std. Dev.	.	.	.		.	4.5	97.7	73.5	71.2	53.3		.	.	.	.	.	.
19																	
Median	.	.	.	5.0	8.0	29.0	6.0	7.0	7.0	5.0	.	.	.	.	.	.	.
Valid N				8	372	3	2873	1611	2765	16							
Mean	.	.	.	6.4	25.9	28.7	31.3	30.5	32.1	38.2	.	.	.	.	.	.	.
Std. Dev.	.	.	.	3.9	50.5	9.5	74.1	60.7	72.0	59.7	.	.	.	.	.	.	.
20																	
Median	.	.	.	10.0	24.0	13.0	6.0	10.0	10.0	8.0	.	.	.	.	.	.	.
Valid N				410	16	1270	636	2765	2951	785							
Mean	.	.	.	30.8	35.6	46.7	25.8	37.5	39.8	31.1	.	.	.	.	.	.	.
Std. Dev.	.	.	.	68.4	32.6	86.9	51.3	79.9	82.3	75.7	.	.	.	.	.	.	.
21																	
Median	.	.	.	10.0	14.0	8.0	8.0	7.0	7.0	67.0	1.0	.	.	.	.	67.0	.
Valid N				214	17	1253	3279	5669	5182	1	1					9	
Mean	.	.	.	37.6	40.2	32.7	34.7	32.4	31.1	67.0	1.0	.	.	.	.	110.6	.
Std. Dev.	.	.	.	90.6	69.7	70.3	74.4	71.2	72.0			.	.	.	.	78.5	.
22																	
Median	.	.	6.0	12.0	5.0	10.0	10.0	9.0	5.0	10.0	.	.	.	.	.	.	.
Valid N			353	21	84	1886	1719	2955	478	329							
Mean	.	.	26.7	12.3	25.8	33.6	40.1	32.6	19.2	36.0	.	.	.	.	.	.	.
Std. Dev.	.	.	50.7	7.6	58.0	70.7	82.6	72.0	39.1	62.1	.	.	.	.	.	.	.
23																	
Median	.	19.0	.	7.5	8.0	18.0	5.0	8.0	.	1.0	.	.	.	.	2.0	233.0	.
Valid N		3		6	709	43	331	509		1					8	5	
Mean	.	43.0	.	7.5	31.9	61.9	19.0	34.0	.	1.0	.	.	.	.	14.6	227.2	.
Std. Dev.	.	54.1	.	2.7	68.3	84.3	36.2	73.3	.		.	.	.	.	23.0	36.4	.

Table C12: Relative humidity outdoor (%)

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
Y-coordinate																			
Not relevant																			
Median	70.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N	30773																		
Mean	67.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	22.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1																			
Median	.	.	.	.	.	.	.	.	.	.	.	69.0	.	80.0	.	.	.	.	.
Valid N												1303		2963					
Mean	.	.	.	.	.	.	.	.	.	.	.	68.4	.	73.7	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	22.4	.	21.1	.	.	.	.	.
2																			
Median	.	.	.	.	.	.	.	.	97.0	.	.	.	94.5	84.0	57.0	.	72.5	.	.
Valid N									3				14	5	4		36		
Mean	.	.	.	.	.	.	.	.	97.0	.	.	.	90.9	83.2	60.8	.	64.3	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	10.2	3.2	9.0	.	20.9	.	.
3																			
Median	.	.	.	.	.	.	.	.	.	88.0	67.0	83.0	80.0	84.0	.	55.0	.	.	.
Valid N										5	8	2265	233	3008		121			
Mean	.	.	.	.	.	.	.	.	.	89.0	68.1	76.1	72.2	76.4	.	56.9	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	3.0	27.8	20.1	21.1	20.0	.	15.0	.	.	.
4																			
Median	.	.	.	.	.	.	.	.	.	.	.	51.0	83.0	85.0	.	.	.	.	.
Valid N												11	6717	11392					
Mean	.	.	.	.	.	.	.	.	.	.	.	50.2	76.1	77.7	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	6.6	19.6	19.4	.	.	.	.	.
5																			
Median	.	.	.	.	.	.	.	.	90.0	.	.	.	81.0	.	67.0	.	.	.	.
Valid N									942				6331		7				
Mean	.	.	.	.	.	.	.	.	84.6	.	.	.	73.9	.	67.1	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	14.4	.	.	.	21.0	.	13.4	.	.	.	.
6																			
Median	.	.	.	.	.	.	.	.	.	79.5	.	84.5	85.0	.	50.5	42.0	.	.	.
Valid N										74		76	6401		148	51			
Mean	.	.	.	.	.	.	.	.	.	70.1	.	81.2	78.6	.	57.1	45.0	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	23.1	.	15.0	18.8	.	20.6	15.2	.	.	.
7																			
Median	.	.	.	.	.	.	.	.	96.0	.	.	84.0	84.0	61.0	48.5	.	.	.	.
Valid N									3			11723	12667	17	310				
Mean	.	.	.	.	.	.	.	.	95.3	.	.	77.1	76.8	58.9	53.5	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	2.1	.	.	19.2	19.4	17.1	15.9	.	.	.	.
8																			
Median	.	.	.	.	.	.	.	79.0	.	.	84.0	82.0	85.0	45.0	44.0	.	.	.	.
Valid N								1231			3907	1813	15881	16	131				
Mean	.	.	.	.	.	.	.	73.0	.	.	77.3	75.8	78.1	45.9	50.2	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	21.0	.	.	19.4	20.1	19.0	5.3	18.4	.	.	.	.
9																			
Median	.	.	.	.	.	68.0	84.0	.	.	.	45.0	82.0	82.0	89.0	.	.	.	.	.
Valid N						36	448				1	10546	3398	1791					
Mean	.	.	.	.	.	66.4	75.7	.	.	.	45.0	75.8	74.1	84.5	.	.	.	.	.
Std. Dev.	.	.	.	.	.	19.9	19.4	.	.	.	.	19.7	21.4	13.2	.	.	.	.	.
10																			
Median	.	.	.	.	91.0	82.5	65.0	89.0	.	91.0	84.0	86.0	84.0	53.0	71.0	.	.	.	.
Valid N					7	590	34	6		1008	24960	21527	5532	240	7				
Mean	.	.	.	.	91.4	74.6	65.8	88.3	.	86.2	77.2	78.8	77.3	60.5	72.1	.	.	.	.
Std. Dev.	.	.	.	.	2.6	21.1	17.3	5.4	.	12.2	19.5	18.8	19.5	22.8	11.1	.	.	.	.

Table C12: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
11 Median	.	.	.	.	.	.	.	.	75.0	75.0	85.0	85.0	66.5	84.0	62.0	.	.	.	.
Valid N									1768	17550	11513	17529	550	2835	19				
Mean	.	.	.	.	.	.	.	.	71.2	70.5	78.0	78.2	64.8	76.3	59.2	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	21.4	21.8	19.0	18.8	21.9	20.2	18.9	.	.	.	.
12 Median	.	.	85.0	.	97.0	.	96.0	80.0	86.0	84.0	85.0	76.0	86.0	69.0	60.5	.	.	.	.
Valid N			2380		5		11	53	1519	10793	15715	785	2163	898	4				
Mean	.	.	76.9	.	97.0	.	88.4	78.3	78.7	76.7	77.3	70.7	79.4	67.6	60.5	.	.	.	.
Std. Dev.	.	.	20.0	.		.	9.0	16.1	18.6	19.7	19.5	20.8	18.4	22.7	22.6	.	.	.	.
13 Median	.	.	.	.	.	.	.	.	87.0	81.0	84.0	84.0	57.0	.	.	.	.	.	.
Valid N									1788	9071	35750	4536	19						
Mean	.	.	.	.	.	.	.	.	78.9	74.1	76.8	76.2	56.8	.	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	20.0	20.7	19.9	20.2	13.7	.	.	.	.	.	.
14 Median	.	.	.	.	.	82.0	.	89.0	83.0	84.0	84.0	85.0	78.0	.	.	61.0	.	.	.
Valid N						25		35	9291	24677	13602	16628	19			80			
Mean	.	.	.	.	.	79.7	.	90.2	76.0	76.5	76.0	78.2	72.6	.	.	61.2	.	.	.
Std. Dev.	.	.	.	.	.	11.2	.	5.1	20.1	19.8	20.5	18.8	18.9	.	.	18.3	.	.	.
15 Median	.	.	.	.	.	65.5	.	.	84.0	83.0	85.0	83.0	83.0	80.0	.	.	.	.	.
Valid N						2			4736	20846	17581	10599	2390	1744					
Mean	.	.	.	.	.	65.5	.	.	77.3	76.5	78.0	76.3	75.9	74.8	.	.	.	.	.
Std. Dev.	.	.	.	.	.	7.8	.	.	19.1	19.5	19.0	19.8	19.9	20.1	.	.	.	.	.
16 Median	.	.	.	.	.	87.0	.	97.0	85.0	83.0	80.0	86.0	.	.	.	86.0	.	.	.
Valid N						3		2	1818	9020	3671	5829				5			
Mean	.	.	.	.	.	87.0	.	97.0	76.8	76.4	73.3	79.5	.	.	.	86.6	.	.	.
Std. Dev.	.	.	.	.	.	3.0	.		20.0	19.8	21.3	18.5	.	.	.	4.6	.	.	.
17 Median	.	.	.	.	97.0	80.0	77.5	83.0	80.0	85.0	83.0	77.5	47.5	.	59.0	.	.	.	.
Valid N					6	166	2	4073	1710	2775	5079	448	4		147				
Mean	.	.	.	.	97.0	70.4	77.5	76.5	74.4	77.5	75.8	73.0	49.8	.	62.6	.	.	.	.
Std. Dev.	.	.	.	.		23.8	27.6	19.6	20.3	19.8	20.0	19.7	9.8	.	19.6	.	.	.	.
18 Median	.	.	.	66.0	.	82.0	85.0	84.0	83.0	84.0	92.0	74.0	.	.	.	.	.	.	.
Valid N				5		55	3656	10965	13656	2720	15	1							
Mean	.	.	.	65.8	.	74.9	78.4	77.0	75.5	76.5	82.5	74.0	.	.	.	.	.	.	.
Std. Dev.	.	.	.	8.4	.	23.0	18.5	19.7	20.2	19.6	18.7		.	.	.	.	.	.	.
19 Median	.	.	97.0	82.0	85.0	79.5	81.0	85.0	85.0	87.0	.	.	.	.	.	.	.	.	.
Valid N			5	72	2766	18	20115	13302	22566	213									
Mean	.	.	97.0	74.1	78.7	73.1	74.5	76.9	78.2	75.8	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.		22.1	19.0	20.1	20.5	20.1	19.0	20.9	.	.	.	.	.	.	.	.	.
20 Median	.	.	.	81.0	68.5	84.0	85.0	83.0	85.0	84.0	.	.	.	.	.	.	.	.	.
Valid N				3297	42	9187	5343	19914	22298	6478									
Mean	.	.	.	74.7	62.4	76.4	78.4	76.2	77.6	76.1	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.	20.2	18.1	19.9	18.7	20.0	19.2	20.1	.	.	.	.	.	.	.	.	.

Table C12: cont.

	X-coordinate																		
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
21																			
Median	.	.	95.0	87.0	88.0	85.0	83.0	82.0	85.0	68.5	29.0	.	.	.	74.5	43.0	.	.	.
Valid N			5	1433	973	11541	22205	39037	39388	16	13				2	11			
Mean	.	.	95.4	79.9	83.1	78.4	76.3	75.0	77.5	71.3	47.1	.	.	.	74.5	47.7	.	.	.
Std. Dev.	.	.	.5	18.7	14.9	18.8	19.7	20.7	19.4	18.5	27.9	.	.	.	10.6	9.0	.	.	.
22																			
Median	.	.	80.0	80.0	70.0	84.0	85.0	81.0	75.0	81.0	.	.	.	.	.	.	.	.	.
Valid N			2464	149	376	13306	13628	20340	3966	2275									
Mean	.	.	74.1	71.6	67.3	76.3	77.6	74.4	70.5	74.7	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	20.4	22.7	21.4	20.1	19.1	20.8	22.3	20.8	.	.	.	.	.	.	.	.	.
23																			
Median	.	89.0	.	54.0	86.0	67.0	82.0	83.0	95.0	89.5	.	.	.	.	79.0	44.0	.	.	.
Valid N		48		13	5113	180	2237	3132	4	16					22	5			
Mean	.	78.2	.	57.7	79.6	68.0	76.0	75.5	94.8	86.6	.	.	.	.	69.0	44.0	.	.	.
Std. Dev.	.	21.9	.	19.3	18.0	22.5	19.7	20.5	.5	12.0	.	.	.	.	17.7	2.2	.	.	.
City																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N																			
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Country																			
Median	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valid N																			
Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Std. Dev.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table C13: Temperature outdoor (°C) - average exposure

	X-coordinate																	
	Not relevant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	City	Country
Y-coordinate																			
Not relevant	8.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	.	.	.	.	.	.	.	.	.	.	.	8.8	.	7.6	.	.	.	.	.
2	.	.	.	.	.	.	.	.	1.2	.	.	.	.9	11.4	19.0	.	13.3	.	.
3	.	.	.	.	.	.	.	.	.	12.2	1.7	6.6	8.8	5.6	.	16.0	.	.	.
4	.	.	.	.	.	.	.	.	.	.	.	23.7	5.9	5.6	.	.	.	.	.
5	.	.	.	.	.	.	.	.	.9	.	.	.	5.8	.	14.1	.	.	.	.
6	.	.	.	.	.	.	.	.	.	8.5	.	3.0	5.2	.	19.3	17.6	.	.	.
7	.	.	.	.	.	.	.	.	4.9	.	.	5.0	5.5	1.2	19.1	.	.	.	.
8	.	.	.	.	.	.	.	7.5	.	.	5.6	6.7	5.6	21.9	18.4	.	.	.	.
9	.	.	.	.	.	10.5	2.7	.	.	.	8.0	6.4	7.1	1.2	.	.	.	.	.
10	.	.	.	.	1.7	5.8	14.0	-.2	.	.0	5.5	4.9	6.2	11.9	-1.8	.	.	.	.
11	.	.	.	.	.	.	.	.	7.1	7.6	5.0	5.5	9.2	6.3	13.1	.	.	.	.
12	.	.	6.0	.	1.8	.	1.2	1.6	4.5	6.3	5.5	11.9	3.5	8.9	9.2	.	.	.	.
13	.	.	.	.	.	.	.	.	4.8	6.3	5.6	5.3	20.1	.	.	.	.	.	.
14	.	.	.	.	.	3.4	.	-.2	6.3	5.9	5.9	5.0	8.3	.	.	11.1	.	.	.
15	.	.	.	.	.	.	.	.	5.2	6.0	5.6	6.3	6.7	6.8	.	.	.	.	.
16	.	.	.	.	.	8.0	.	1.2	6.3	6.2	6.7	4.5	.	.	.	-.4	.	.	.
17	.	.	.	.	-1.7	7.5	13.0	5.8	5.2	6.0	6.0	8.0	15.9	.	5.6	.	.	.	.
18	.	.	.	11.6	.	7.7	5.6	6.0	6.0	4.9	9.1	-1.5	.	.	.	.	.	.	.
19	.	.	1.0	4.4	4.1	2.8	6.5	5.4	5.1	6.0	.	.	.	.	.	.	.	.	.
20	.	.	.	6.5	12.4	5.4	4.4	5.8	5.2	5.6	.	.	.	.	.	.	.	.	.
21	.	.	-.6	6.4	.3	5.1	6.0	6.4	5.5	6.2	8.5	.	.	.	16.3	19.6	.	.	.
22	.	.	6.8	6.7	7.9	6.1	5.4	6.4	7.0	4.9	.	.	.	.	.	.	.	.	.
23	.	4.0	.	14.5	5.6	10.4	6.4	6.9	.2	8.6	.	.	.	.	9.3	18.6	.	.	.
City	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Country	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

APPENDIX 4

Exposure to each air pollution contaminant
by season and hour

Sulfur dioxide (µg/m³)

	season	
	winter	summer
Hour of day		
1		
Median	8.0	6.0
Valid N	19997	18540
Mean	9.4	7.8
Std. Dev.	10.1	13.6
2		
Median	8.0	5.0
Valid N	19997	18540
Mean	9.6	8.2
Std. Dev.	13.9	37.5
3		
Median	7.0	5.0
Valid N	19997	18540
Mean	9.7	7.8
Std. Dev.	13.4	20.5
4		
Median	7.0	5.0
Valid N	19997	18540
Mean	9.5	7.3
Std. Dev.	12.9	14.1
5		
Median	8.0	5.0
Valid N	19997	18540
Mean	9.3	7.4
Std. Dev.	9.0	14.1
6		
Median	8.0	6.0
Valid N	19997	18540
Mean	10.0	8.1
Std. Dev.	11.7	16.9
7		
Median	9.0	6.0
Valid N	19997	18540
Mean	10.6	8.5
Std. Dev.	11.8	18.1
8		
Median	10.0	7.0
Valid N	19997	18540
Mean	11.5	8.1
Std. Dev.	11.1	11.5
9		
Median	10.0	6.0
Valid N	19997	18540
Mean	11.2	7.1
Std. Dev.	9.6	7.4
10		
Median	10.0	6.0
Valid N	19997	18540
Mean	10.9	6.5
Std. Dev.	9.1	6.5
11		
Median	10.0	6.0
Valid N	19997	18540
Mean	11.0	7.0
Std. Dev.	8.8	12.0
12		
Median	10.0	6.0
Valid N	19997	18540
Mean	11.5	6.0
Std. Dev.	11.9	6.1

Sulfur dioxide cont.

	season	
	winter	summer
Hour of day		
13		
Median	10.0	6.0
Valid N	19997	18540
Mean	11.1	6.1
Std. Dev.	10.1	7.2
14		
Median	9.0	6.0
Valid N	19997	18540
Mean	11.0	6.3
Std. Dev.	10.8	6.1
15		
Median	9.0	6.0
Valid N	19997	18540
Mean	10.3	6.2
Std. Dev.	8.1	6.3
16		
Median	9.0	6.0
Valid N	19997	18540
Mean	10.1	6.2
Std. Dev.	7.1	5.7
17		
Median	9.0	6.0
Valid N	19997	18540
Mean	10.1	6.2
Std. Dev.	7.0	6.5
18		
Median	9.0	6.0
Valid N	19997	18540
Mean	9.5	6.1
Std. Dev.	5.9	5.9
19		
Median	9.0	6.0
Valid N	19997	18540
Mean	10.1	6.1
Std. Dev.	11.9	6.2
20		
Median	9.0	6.0
Valid N	19997	18540
Mean	9.9	6.4
Std. Dev.	12.4	6.8
21		
Median	9.0	6.0
Valid N	19997	18540
Mean	9.6	7.3
Std. Dev.	7.6	8.5
22		
Median	8.0	7.0
Valid N	19997	18540
Mean	9.2	7.5
Std. Dev.	6.3	13.8
23		
Median	8.0	6.0
Valid N	19997	18540
Mean	9.1	7.8
Std. Dev.	7.0	15.7
24		
Median	8.0	6.0
Valid N	19997	18540
Mean	9.5	7.7
Std. Dev.	8.5	11.6

Nitrogen monoxide ($\mu g/m^3$)

	season	
	winter	summer
Hour of day		
1		
Median	1.0	1.0
Valid N	19997	18540
Mean	4.7	3.5
Std. Dev.	12.7	9.3
2		
Median	1.0	1.0
Valid N	19997	18540
Mean	4.2	2.8
Std. Dev.	10.6	7.1
3		
Median	.5	1.0
Valid N	19997	18540
Mean	3.0	2.4
Std. Dev.	8.7	6.1
4		
Median	.5	1.0
Valid N	19997	18540
Mean	2.5	2.1
Std. Dev.	8.5	4.0
5		
Median	1.0	1.0
Valid N	19997	18540
Mean	2.3	3.2
Std. Dev.	7.5	5.9
6		
Median	1.0	3.0
Valid N	19997	18540
Mean	3.1	5.1
Std. Dev.	8.0	9.0
7		
Median	2.0	3.0
Valid N	19997	18540
Mean	7.1	9.5
Std. Dev.	18.3	38.2
8		
Median	3.0	4.0
Valid N	19997	18540
Mean	19.6	17.5
Std. Dev.	57.1	72.5
9		
Median	4.0	3.0
Valid N	19997	18540
Mean	14.0	5.5
Std. Dev.	36.6	28.2
10		
Median	5.0	2.0
Valid N	19997	18540
Mean	14.5	3.8
Std. Dev.	31.5	16.4
11		
Median	5.0	2.0
Valid N	19997	18540
Mean	15.7	4.1
Std. Dev.	37.8	22.7
12		
Median	6.0	2.0
Valid N	19997	18540
Mean	18.0	4.0
Std. Dev.	47.0	19.3

Nitrogen monoxide cont.

	season	
	winter	summer
Hour of day		
13		
Median	6.0	2.0
Valid N	19997	18540
Mean	15.4	4.3
Std. Dev.	37.6	22.7
14		
Median	5.0	2.0
Valid N	19997	18540
Mean	15.5	4.3
Std. Dev.	40.7	23.4
15		
Median	4.0	2.0
Valid N	19997	18540
Mean	15.5	4.0
Std. Dev.	47.0	20.7
16		
Median	4.0	2.0
Valid N	19997	18539
Mean	44.4	35.3
Std. Dev.	133.9	123.1
17		
Median	3.0	2.0
Valid N	19997	18540
Mean	17.8	4.0
Std. Dev.	52.0	26.6
18		
Median	3.0	1.0
Valid N	19997	18540
Mean	17.3	4.2
Std. Dev.	39.7	30.6
19		
Median	3.0	1.0
Valid N	19997	18540
Mean	15.9	3.6
Std. Dev.	34.7	28.1
20		
Median	2.0	1.0
Valid N	19997	18540
Mean	11.8	3.8
Std. Dev.	28.5	19.8
21		
Median	2.0	2.0
Valid N	19997	18540
Mean	11.2	6.0
Std. Dev.	26.3	21.7
22		
Median	2.0	2.0
Valid N	19997	18540
Mean	9.0	5.6
Std. Dev.	22.8	14.1
23		
Median	2.0	1.0
Valid N	19997	18540
Mean	6.9	4.2
Std. Dev.	17.5	10.8
24		
Median	1.0	1.0
Valid N	19997	18540
Mean	5.8	3.2
Std. Dev.	15.6	9.2

Nitrogen dioxide (μg/m³)

	season	
	winter	summer
Hour of day		
1		
Median	10.0	14.0
Valid N	19997	18540
Mean	12.6	15.8
Std. Dev.	9.5	12.5
2		
Median	9.0	12.0
Valid N	19997	18540
Mean	12.0	13.9
Std. Dev.	9.3	11.3
3		
Median	9.0	10.0
Valid N	19997	18540
Mean	11.2	12.1
Std. Dev.	8.5	9.9
4		
Median	8.0	10.0
Valid N	19997	18540
Mean	10.6	11.1
Std. Dev.	8.1	9.1
5		
Median	9.0	10.0
Valid N	19997	18540
Mean	10.5	11.1
Std. Dev.	7.8	8.7
6		
Median	10.0	13.0
Valid N	19997	18540
Mean	11.4	14.2
Std. Dev.	8.0	10.9
7		
Median	11.0	14.0
Valid N	19997	18540
Mean	13.5	17.0
Std. Dev.	9.4	14.9
8		
Median	14.0	13.0
Valid N	19997	18540
Mean	16.1	16.5
Std. Dev.	11.9	17.4
9		
Median	14.0	12.0
Valid N	19997	18540
Mean	15.0	12.6
Std. Dev.	9.6	10.7
10		
Median	13.0	10.0
Valid N	19997	18540
Mean	14.5	10.8
Std. Dev.	8.9	8.2
11		
Median	14.0	10.0
Valid N	19997	18540
Mean	14.8	10.4
Std. Dev.	9.5	8.5
12		
Median	14.0	10.0
Valid N	19997	18540
Mean	15.9	10.0
Std. Dev.	10.9	8.2

Nitrogen dioxide cont.

	season	
	winter	summer
Hour of day		
13		
Median	14.0	10.0
Valid N	19997	18540
Mean	15.7	10.5
Std. Dev.	10.7	9.1
14		
Median	10.0	11.0
Valid N	19997	18540
Mean	15.4	11.1
Std. Dev.	10.6	9.3
15		
Median	14.0	12.0
Valid N	19997	18540
Mean	15.5	11.6
Std. Dev.	10.4	9.1
16		
Median	15.0	13.0
Valid N	19997	18539
Mean	19.1	20.5
Std. Dev.	18.7	30.8
17		
Median	16.0	11.0
Valid N	19997	18540
Mean	16.8	11.5
Std. Dev.	9.7	11.3
18		
Median	16.0	11.0
Valid N	19997	18540
Mean	16.3	12.7
Std. Dev.	8.2	12.2
19		
Median	16.0	12.0
Valid N	19997	18540
Mean	16.3	13.9
Std. Dev.	8.2	12.1
20		
Median	15.0	14.0
Valid N	19997	18540
Mean	15.4	16.9
Std. Dev.	7.6	15.0
21		
Median	15.0	16.0
Valid N	19997	18540
Mean	14.8	20.6
Std. Dev.	6.7	18.4
22		
Median	14.0	17.0
Valid N	19997	18540
Mean	14.6	21.2
Std. Dev.	6.6	18.1
23		
Median	14.0	15.0
Valid N	19997	18540
Mean	14.3	18.7
Std. Dev.	6.8	15.2
24		
Median	13.0	14.0
Valid N	19997	18540
Mean	14.2	16.1
Std. Dev.	8.0	12.5

Ozone ($\mu g/m^3$)

	season	
	winter	summer
Hour of day		
1		
Median	6.0	18.0
Valid N	19997	18540
Mean	13.0	32.2
Std. Dev.	17.5	31.6
2		
Median	7.0	20.0
Valid N	19997	18540
Mean	14.2	34.0
Std. Dev.	17.9	32.5
3		
Median	8.0	17.0
Valid N	19997	18540
Mean	15.1	33.4
Std. Dev.	17.8	33.0
4		
Median	8.0	18.0
Valid N	19997	18540
Mean	15.5	32.0
Std. Dev.	17.4	31.7
5		
Median	8.0	17.0
Valid N	19997	18540
Mean	15.3	30.7
Std. Dev.	17.0	31.8
6		
Median	7.0	15.0
Valid N	19997	18540
Mean	13.6	28.6
Std. Dev.	16.2	31.0
7		
Median	4.0	14.0
Valid N	19997	18540
Mean	10.0	27.8
Std. Dev.	14.4	30.8
8		
Median	2.0	17.0
Valid N	19997	18540
Mean	7.6	31.5
Std. Dev.	12.7	32.0
9		
Median	2.0	18.0
Valid N	19997	18540
Mean	6.7	34.9
Std. Dev.	11.2	34.1
10		
Median	3.0	20.0
Valid N	19997	18540
Mean	6.5	40.6
Std. Dev.	10.7	38.4
11		
Median	3.0	23.0
Valid N	19997	18540
Mean	6.9	46.6
Std. Dev.	11.0	42.4
12		
Median	3.0	25.0
Valid N	19997	18540
Mean	7.7	49.2
Std. Dev.	12.1	43.5

Ozone cont.

	season	
	winter	summer
Hour of day		
13		
Median	3.0	25.0
Valid N	19997	18540
Mean	8.0	49.0
Std. Dev.	12.8	43.6
14		
Median	3.0	26.0
Valid N	19997	18540
Mean	7.8	48.8
Std. Dev.	12.4	43.0
15		
Median	2.0	28.0
Valid N	19997	18540
Mean	6.7	49.1
Std. Dev.	11.3	43.8
16		
Median	1.0	23.0
Valid N	19997	18540
Mean	5.2	45.9
Std. Dev.	9.3	43.7
17		
Median	1.0	29.0
Valid N	19997	18540
Mean	5.2	49.9
Std. Dev.	8.9	44.3
18		
Median	.5	31.0
Valid N	19997	18540
Mean	4.7	49.9
Std. Dev.	8.1	44.0
19		
Median	2.0	25.0
Valid N	19997	18540
Mean	4.8	45.0
Std. Dev.	7.8	41.6
20		
Median	2.0	18.0
Valid N	19997	18540
Mean	4.8	36.1
Std. Dev.	7.4	37.6
21		
Median	2.0	14.0
Valid N	19997	18540
Mean	4.7	28.7
Std. Dev.	7.0	33.2
22		
Median	3.0	12.0
Valid N	19997	18540
Mean	5.0	22.6
Std. Dev.	7.3	28.3
23		
Median	3.0	11.0
Valid N	19997	18540
Mean	5.9	21.1
Std. Dev.	9.2	26.7
24		
Median	4.0	13.0
Valid N	19997	18540
Mean	8.3	24.4
Std. Dev.	12.9	27.7

Carbon monoxide (mg/m^3)*

	season	
	winter	summer
Hour of day		
1		
Median	.	3.0*
Valid N		2
Mean	.	3.0
Std. Dev.	.	1.4
7		
Median	4.0	4.0
Valid N	24	113
Mean	4.0	4.4
Std. Dev.	1.6	3.0
8		
Median	1.0	1.0
Valid N	793	911
Mean	2.2	2.8
Std. Dev.	2.0	2.8
9		
Median	4.0	3.0
Valid N	44	88
Mean	4.3	4.0
Std. Dev.	3.0	3.1
10		
Median	4.5	4.5
Valid N	32	32
Mean	4.5	4.2
Std. Dev.	2.6	2.6
11		
Median	4.0	3.0
Valid N	143	62
Mean	3.8	4.0
Std. Dev.	2.5	2.9
12		
Median	2.0	3.0
Valid N	304	47
Mean	3.1	3.8
Std. Dev.	2.4	2.6
13		
Median	2.0	2.0
Valid N	142	69
Mean	3.5	3.7
Std. Dev.	2.4	2.8
14		
Median	3.0	3.5
Valid N	212	74
Mean	3.4	3.9
Std. Dev.	2.3	2.9
15		
Median	2.0	5.0
Valid N	271	46
Mean	3.2	4.3
Std. Dev.	2.5	2.9
16		
Median	3.0	2.0
Valid N	2234	2472
Mean	3.9	3.4
Std. Dev.	3.7	3.2
17		
Median	2.0	2.0
Valid N	204	134
Mean	3.1	3.2
Std. Dev.	2.6	2.5

Carbon monoxide cont.

	season	
	winter	summer
Hour of day		
18		
Median	3.0	2.0
Valid N	53	192
Mean	3.4	2.9
Std. Dev.	2.8	2.5
19		
Median	2.0	2.0
Valid N	49	129
Mean	3.1	3.2
Std. Dev.	2.1	2.5
20		
Median	3.0	3.0
Valid N	11	46
Mean	3.5	3.7
Std. Dev.	3.2	2.4
21		
Median	1.0	2.0
Valid N	3	31
Mean	1.3	3.7
Std. Dev.	.6	2.7
22		
Median	3.5	2.0
Valid N	8	7
Mean	3.3	3.3
Std. Dev.	1.8	2.4
23		
Median	5.0	5.0
Valid N	1	3
Mean	5.0	5.3
Std. Dev.		2.5
24		
Median	.	3.0
Valid N		6
Mean	.	3.3
Std. Dev.	.	2.4

*Non-zero CO-values only

Total chlorine (µg/m³)

	season	
	winter	summer
Hour of day		
1		
Median	.5	.5
Valid N	19997	18540
Mean	1.8	.7
Std. Dev.	5.5	1.1
2		
Median	.5	.5
Valid N	19997	18540
Mean	1.7	.7
Std. Dev.	5.4	1.3
3		
Median	.5	.5
Valid N	19997	18540
Mean	1.6	.7
Std. Dev.	5.5	1.4
4		
Median	.5	.5
Valid N	19997	18540
Mean	1.7	.7
Std. Dev.	5.7	1.0
5		
Median	.5	.5
Valid N	19997	18540
Mean	1.7	.7
Std. Dev.	6.0	.9
6		
Median	.5	.5
Valid N	19997	18540
Mean	1.8	.7
Std. Dev.	5.4	.8
7		
Median	.5	.5
Valid N	19997	18540
Mean	1.6	.6
Std. Dev.	4.7	.6
8		
Median	.5	.5
Valid N	19997	18540
Mean	1.6	.6
Std. Dev.	5.3	.6
9		
Median	.5	.5
Valid N	19997	18540
Mean	1.7	.6
Std. Dev.	5.4	.6
10		
Median	.5	.5
Valid N	19996	18540
Mean	1.8	.6
Std. Dev.	6.2	.6
11		
Median	.5	.5
Valid N	19997	18540
Mean	1.7	.6
Std. Dev.	4.9	.4
12		
Median	.5	.5
Valid N	19997	18540
Mean	1.6	.6
Std. Dev.	4.9	.4

Total chlorine cont.

	season	
	winter	summer
Hour of day		
13		
Median	.5	.5
Valid N	19997	18540
Mean	1.6	.6
Std. Dev.	4.2	.4
14		
Median	.5	.5
Valid N	19997	18540
Mean	1.6	.6
Std. Dev.	4.3	.4
15		
Median	.5	.5
Valid N	19997	18540
Mean	1.5	.6
Std. Dev.	4.2	.3
16		
Median	.5	.5
Valid N	19997	18540
Mean	1.5	.6
Std. Dev.	4.2	.2
17		
Median	.5	.5
Valid N	19997	18540
Mean	1.3	.6
Std. Dev.	3.7	.3
18		
Median	.5	.5
Valid N	19997	18540
Mean	1.4	.6
Std. Dev.	3.9	.4
19		
Median	.5	.5
Valid N	19997	18540
Mean	1.4	.6
Std. Dev.	4.1	.4
20		
Median	.5	.5
Valid N	19997	18540
Mean	1.5	.6
Std. Dev.	3.9	.5
21		
Median	.5	.5
Valid N	19997	18540
Mean	1.3	.6
Std. Dev.	3.6	.5
22		
Median	.5	.5
Valid N	19997	18540
Mean	1.4	.7
Std. Dev.	4.3	.9
23		
Median	.5	.5
Valid N	19997	18540
Mean	1.4	.7
Std. Dev.	4.1	1.0
24		
Median	.5	.5
Valid N	19997	18540
Mean	1.5	.7
Std. Dev.	4.6	1.0

Suspended particles - fine fraction ($\mu g/m^3$)

	season	
	winter	summer
Hour of day		
1		
Median	9.0	8.0
Valid N	19997	18540
Mean	19.8	14.1
Std. Dev.	25.6	20.7
2		
Median	9.0	8.0
Valid N	19997	18540
Mean	19.2	13.7
Std. Dev.	25.7	18.7
3		
Median	8.0	9.0
Valid N	19997	18540
Mean	18.1	13.4
Std. Dev.	24.1	18.0
4		
Median	8.0	8.0
Valid N	19997	18540
Mean	17.8	12.6
Std. Dev.	24.7	15.6
5		
Median	8.0	8.0
Valid N	19997	18540
Mean	18.3	12.4
Std. Dev.	25.1	15.2
6		
Median	8.0	8.0
Valid N	19997	18540
Mean	17.7	12.3
Std. Dev.	23.6	14.9
7		
Median	8.0	8.0
Valid N	19997	18540
Mean	18.7	12.8
Std. Dev.	23.8	16.4
8		
Median	13.0	10.0
Valid N	19997	18540
Mean	30.2	17.2
Std. Dev.	35.1	19.8
9		
Median	15.0	10.0
Valid N	19997	18540
Mean	34.7	16.3
Std. Dev.	38.1	18.4
10		
Median	18.0	9.0
Valid N	19997	18540
Mean	37.2	15.5
Std. Dev.	39.2	17.7
11		
Median	24.0	9.0
Valid N	19997	18540
Mean	39.4	14.6
Std. Dev.	40.0	16.7
12		
Median	24.0	9.0
Valid N	19997	18540
Mean	39.9	14.1
Std. Dev.	40.1	16.0

Suspended particles - fine fraction cont.

	season	
	winter	summer
Hour of day		
13		
Median	23.0	9.0
Valid N	19997	18540
Mean	39.0	13.6
Std. Dev.	39.7	15.4
14		
Median	22.0	9.0
Valid N	19997	18540
Mean	38.6	13.9
Std. Dev.	39.3	15.3
15		
Median	23.0	9.0
Valid N	19997	18540
Mean	38.8	14.3
Std. Dev.	39.4	15.7
16		
Median	25.0	11.0
Valid N	19997	18540
Mean	39.6	16.8
Std. Dev.	40.2	18.8
17		
Median	16.0	9.0
Valid N	19997	18540
Mean	33.8	13.2
Std. Dev.	37.1	13.9
18		
Median	18.0	10.0
Valid N	19997	18540
Mean	34.6	13.6
Std. Dev.	37.3	14.0
19		
Median	18.0	10.0
Valid N	19997	18540
Mean	35.5	13.9
Std. Dev.	38.3	14.8
20		
Median	17.0	9.0
Valid N	19997	18540
Mean	27.9	12.4
Std. Dev.	31.6	13.9
21		
Median	14.0	9.0
Valid N	19997	18540
Mean	27.2	12.8
Std. Dev.	31.4	15.3
22		
Median	13.0	9.0
Valid N	19997	18540
Mean	25.2	14.0
Std. Dev.	29.4	17.6
23		
Median	12.0	9.0
Valid N	19997	18540
Mean	23.4	14.1
Std. Dev.	28.4	17.3
24		
Median	10.0	8.0
Valid N	19997	18540
Mean	21.7	13.9
Std. Dev.	26.1	18.4

Nitrate ($\mu g/m^3$)

	season	
	winter	summer
Hour of day		
1		
Median	.5	.5
Valid N	19997	18540
Mean	.7	.8
Std. Dev.	.6	.8
2		
Median	.5	.5
Valid N	19997	18540
Mean	.7	.8
Std. Dev.	.6	.8
3		
Median	.5	.5
Valid N	19997	18540
Mean	.7	.8
Std. Dev.	.6	.8
4		
Median	.5	.5
Valid N	19997	18540
Mean	.7	.8
Std. Dev.	.6	.8
5		
Median	.5	.5
Valid N	19997	18540
Mean	.7	.8
Std. Dev.	.6	.8
6		
Median	.5	.5
Valid N	19997	18540
Mean	.7	.8
Std. Dev.	.6	.8
7		
Median	.5	.5
Valid N	19997	18540
Mean	.7	.8
Std. Dev.	.6	.8
8		
Median	.5	.5
Valid N	19997	18540
Mean	.8	.9
Std. Dev.	.5	.5
9		
Median	.5	1.0
Valid N	19997	18540
Mean	.8	.9
Std. Dev.	.5	.5
10		
Median	.5	1.0
Valid N	19997	18540
Mean	.8	.9
Std. Dev.	.5	.5
11		
Median	.5	.5
Valid N	19997	18540
Mean	.8	.8
Std. Dev.	.5	.5
12		
Median	.5	.5
Valid N	19997	18540
Mean	.8	.8
Std. Dev.	.5	.5

Nitrate cont.

	season	
	winter	summer
Hour of day		
13		
Median	.5	.5
Valid N	19997	18540
Mean	.8	.8
Std. Dev.	.5	.5
14		
Median	.5	.5
Valid N	19997	18540
Mean	.8	.8
Std. Dev.	.5	.5
15		
Median	.5	.5
Valid N	19997	18540
Mean	.8	.8
Std. Dev.	.5	.5
16		
Median	.5	.5
Valid N	19997	18540
Mean	.8	.8
Std. Dev.	.5	.5
17		
Median	.5	.5
Valid N	19997	18540
Mean	.8	.8
Std. Dev.	.5	.6
18		
Median	.5	.5
Valid N	19997	18540
Mean	.8	.8
Std. Dev.	.5	.6
19		
Median	.5	.5
Valid N	19997	18540
Mean	.8	.8
Std. Dev.	.5	.5
20		
Median	.5	.5
Valid N	19997	18540
Mean	.7	.8
Std. Dev.	.5	.8
21		
Median	.5	.5
Valid N	19997	18540
Mean	.7	.8
Std. Dev.	.5	.8
22		
Median	.5	.5
Valid N	19997	18540
Mean	.6	.8
Std. Dev.	.5	.8
23		
Median	.5	.5
Valid N	19997	18540
Mean	.6	.8
Std. Dev.	.5	.8
24		
Median	.5	.5
Valid N	19997	18540
Mean	.7	.8
Std. Dev.	.5	.8

Sulfate (µg/m³)

	season	
	winter	summer
Hour of day		
1		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.6	2.7
Std. Dev.	2.5	2.7
2		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.6	2.7
Std. Dev.	2.5	2.7
3		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.7	2.7
Std. Dev.	2.5	2.7
4		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.7	2.7
Std. Dev.	2.5	2.7
5		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.7	2.7
Std. Dev.	2.5	2.7
6		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.7	2.7
Std. Dev.	2.5	2.7
7		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.6	2.7
Std. Dev.	2.5	2.7
8		
Median	2.0	2.0
Valid N	19997	18540
Mean	3.0	3.1
Std. Dev.	2.5	3.2
9		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.9	3.1
Std. Dev.	2.4	3.1
10		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.9	3.0
Std. Dev.	2.4	3.1
11		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.9	3.0
Std. Dev.	2.4	3.1
12		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.9	3.0
Std. Dev.	2.4	3.2

Sulfate cont.

	season	
	winter	summer
Hour of day		
13		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.9	3.0
Std. Dev.	2.4	3.2
14		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.9	2.9
Std. Dev.	2.4	3.2
15		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.9	2.9
Std. Dev.	2.4	3.2
16		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.9	3.0
Std. Dev.	2.4	3.2
17		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.9	3.0
Std. Dev.	2.4	3.2
18		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.9	3.0
Std. Dev.	2.3	3.2
19		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.8	3.0
Std. Dev.	2.3	3.2
20		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.3	2.6
Std. Dev.	2.3	2.6
21		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.3	2.6
Std. Dev.	2.2	2.6
22		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.3	2.6
Std. Dev.	2.2	2.6
23		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.3	2.6
Std. Dev.	2.3	2.6
24		
Median	2.0	2.0
Valid N	19997	18540
Mean	2.4	2.6
Std. Dev.	2.4	2.6

Grass pollen (pollen/m³)*

	season
	summer
Hour of day	
1	
Median	5.0
Valid N	1878
Mean	12.7
Std. Dev.	17.7
2	
Median	5.0
Valid N	2422
Mean	8.9
Std. Dev.	9.9
3	
Median	5.0
Valid N	2713
Mean	9.7
Std. Dev.	8.7
4	
Median	19.0
Valid N	2164
Mean	22.1
Std. Dev.	21.9
5	
Median	14.0
Valid N	2958
Mean	146.9
Std. Dev.	228.3
6	
Median	5.0
Valid N	4349
Mean	213.7
Std. Dev.	535.8
7	
Median	5.0
Valid N	4043
Mean	154.2
Std. Dev.	373.6
8	
Median	5.0
Valid N	4544
Mean	55.0
Std. Dev.	116.3
9	
Median	5.0
Valid N	4251
Mean	47.5
Std. Dev.	120.3
10	
Median	10.0
Valid N	3875
Mean	54.8
Std. Dev.	102.4
11	
Median	14.0
Valid N	4118
Mean	88.5
Std. Dev.	150.0
12	
Median	10.0
Valid N	3810
Mean	106.9
Std. Dev.	192.6

Grass pollen cont.

	season
	summer
Hour of day	
13	
Median	10.0
Valid N	3998
Mean	108.3
Std. Dev.	187.1
14	
Median	10.0
Valid N	4999
Mean	47.8
Std. Dev.	92.7
15	
Median	10.0
Valid N	3965
Mean	43.8
Std. Dev.	67.1
16	
Median	10.0
Valid N	4820
Mean	19.0
Std. Dev.	30.4
17	
Median	10.0
Valid N	3164
Mean	22.1
Std. Dev.	27.5
18	
Median	10.0
Valid N	2961
Mean	11.0
Std. Dev.	8.6
19	
Median	5.0
Valid N	2202
Mean	10.7
Std. Dev.	10.1
20	
Median	5.0
Valid N	3334
Mean	9.3
Std. Dev.	13.2
21	
Median	5.0
Valid N	2812
Mean	7.0
Std. Dev.	7.1
22	
Median	5.0
Valid N	2448
Mean	7.9
Std. Dev.	8.4
23	
Median	10.0
Valid N	1863
Mean	7.7
Std. Dev.	5.5
24	
Median	5.0
Valid N	2215
Mean	7.6
Std. Dev.	8.2

*Zero recoded as missing

Birch pollen (pollen/m³)*

	season
	summer
Hour of day	
1	
Median	24.0
Valid N	3045
Mean	47.2
Std. Dev.	99.2
2	
Median	8.0
Valid N	4598
Mean	49.0
Std. Dev.	91.0
3	
Median	10.0
Valid N	5156
Mean	49.5
Std. Dev.	90.3
4	
Median	19.0
Valid N	3423
Mean	63.6
Std. Dev.	97.3
5	
Median	14.0
Valid N	4994
Mean	61.7
Std. Dev.	156.6
6	
Median	7.0
Valid N	5067
Mean	45.6
Std. Dev.	123.4
7	
Median	10.0
Valid N	5459
Mean	38.1
Std. Dev.	73.1
8	
Median	14.0
Valid N	4585
Mean	36.9
Std. Dev.	55.1
9	
Median	5.0
Valid N	4637
Mean	33.0
Std. Dev.	57.3
10	
Median	9.0
Valid N	5180
Mean	33.3
Std. Dev.	58.5
11	
Median	10.0
Valid N	6137
Mean	26.7
Std. Dev.	45.5
12	
Median	10.0
Valid N	5692
Mean	30.6
Std. Dev.	50.7

Birch pollen cont.

	season
	summer
Hour of day	
13	
Median	8.0
Valid N	5130
Mean	34.2
Std. Dev.	58.0
14	
Median	5.0
Valid N	6018
Mean	23.9
Std. Dev.	44.7
15	
Median	7.0
Valid N	5275
Mean	30.1
Std. Dev.	57.7
16	
Median	6.0
Valid N	5530
Mean	27.8
Std. Dev.	56.6
17	
Median	5.0
Valid N	3378
Mean	27.9
Std. Dev.	38.4
18	
Median	17.0
Valid N	3606
Mean	33.8
Std. Dev.	45.4
19	
Median	10.0
Valid N	4387
Mean	25.1
Std. Dev.	43.3
20	
Median	8.0
Valid N	3625
Mean	31.1
Std. Dev.	56.9
21	
Median	5.0
Valid N	5035
Mean	20.1
Std. Dev.	41.4
22	
Median	9.0
Valid N	3424
Mean	20.5
Std. Dev.	33.5
23	
Median	5.0
Valid N	4326
Mean	18.6
Std. Dev.	35.0
24	
Median	7.0
Valid N	4867
Mean	20.4
Std. Dev.	37.4

*Zero recoded as missing

Relative humidity outdoors (per cent)

	season	
	winter	summer
Hour of day		
1		
Median	90.0	85.0
Valid N	18676	16338
Mean	87.6	82.3
Std. Dev.	9.3	12.9
2		
Median	90.0	89.0
Valid N	18686	16345
Mean	87.4	84.7
Std. Dev.	9.6	12.0
3		
Median	91.0	91.0
Valid N	18698	16357
Mean	87.7	85.1
Std. Dev.	9.5	13.0
4		
Median	92.0	89.0
Valid N	18707	16361
Mean	88.0	83.9
Std. Dev.	9.2	13.9
5		
Median	93.0	86.0
Valid N	18708	16365
Mean	88.4	82.2
Std. Dev.	9.0	14.0
6		
Median	91.0	79.0
Valid N	18707	16369
Mean	88.7	77.7
Std. Dev.	8.8	16.2
7		
Median	91.0	72.0
Valid N	18701	16338
Mean	88.5	72.1
Std. Dev.	8.7	17.1
8		
Median	92.0	65.0
Valid N	18630	16274
Mean	88.2	65.5
Std. Dev.	8.8	17.4
9		
Median	90.0	58.0
Valid N	18543	16187
Mean	87.5	60.2
Std. Dev.	9.8	17.5
10		
Median	89.0	50.0
Valid N	18403	16012
Mean	85.9	54.5
Std. Dev.	11.1	18.1
11		
Median	89.0	46.0
Valid N	18298	15746
Mean	84.7	51.9
Std. Dev.	12.3	18.5
12		
Median	88.0	45.0
Valid N	18185	15505
Mean	83.0	51.0
Std. Dev.	14.1	18.0

Relative humidity outdoors cont.

	season	
	winter	summer
Hour of day		
13		
Median	88.0	44.0
Valid N	18102	15319
Mean	81.5	50.1
Std. Dev.	15.3	17.2
14		
Median	87.0	46.0
Valid N	18073	15269
Mean	81.3	49.4
Std. Dev.	16.0	18.1
15		
Median	87.0	45.0
Valid N	18090	15276
Mean	81.0	47.9
Std. Dev.	16.3	16.0
16		
Median	89.0	42.0
Valid N	18227	15355
Mean	82.6	47.9
Std. Dev.	15.4	16.0
17		
Median	90.0	43.0
Valid N	18345	15421
Mean	84.1	48.2
Std. Dev.	14.4	16.3
18		
Median	90.0	44.0
Valid N	18396	15391
Mean	85.1	50.2
Std. Dev.	13.6	17.3
19		
Median	91.0	47.0
Valid N	18349	15383
Mean	85.4	53.4
Std. Dev.	13.2	18.5
20		
Median	92.0	54.0
Valid N	18317	15501
Mean	86.0	57.7
Std. Dev.	12.9	19.1
21		
Median	91.0	62.0
Valid N	18371	15696
Mean	86.3	65.1
Std. Dev.	12.4	17.5
22		
Median	91.0	72.0
Valid N	18436	15891
Mean	86.9	72.0
Std. Dev.	11.8	15.5
23		
Median	93.0	78.0
Valid N	18486	16045
Mean	87.3	77.3
Std. Dev.	11.3	14.2
24		
Median	92.0	84.0
Valid N	18549	16148
Mean	87.4	81.0
Std. Dev.	11.0	12.5

Temperature outdoors (degrees C)

	season	
	winter	summer
Hour of day		
1		
Median	.4	9.2
Valid N	18676	16338
Mean	-.2	8.5
Std. Dev.	3.1	4.6
2		
Median	.2	8.2
Valid N	18686	16345
Mean	-.3	8.1
Std. Dev.	3.2	4.5
3		
Median	.1	7.7
Valid N	18698	16357
Mean	-.4	7.7
Std. Dev.	3.2	4.5
4		
Median	-.1	7.5
Valid N	18707	16361
Mean	-.6	7.7
Std. Dev.	3.3	4.7
5		
Median	-.1	8.7
Valid N	18708	16365
Mean	-.7	8.3
Std. Dev.	3.3	5.1
6		
Median	-.4	9.7
Valid N	18707	16369
Mean	-.8	9.6
Std. Dev.	3.4	5.2
7		
Median	-.5	11.1
Valid N	18701	16338
Mean	-.9	11.1
Std. Dev.	3.4	5.2
8		
Median	-.5	12.8
Valid N	18630	16274
Mean	-.8	12.7
Std. Dev.	3.4	5.4
9		
Median	-.4	14.1
Valid N	18543	16187
Mean	-.7	14.2
Std. Dev.	3.1	5.5
10		
Median	-.3	15.1
Valid N	18403	16012
Mean	-.2	15.2
Std. Dev.	2.9	5.7
11		
Median		15.1
Valid N	18298	15746
Mean	.1	15.7
Std. Dev.	2.6	5.7
12		
Median	.5	15.5
Valid N	18185	15505
Mean	.6	16.4
Std. Dev.	2.5	5.7

Temperature outdoors cont.

	season	
	winter	summer
Hour of day		
13		
Median	.8	16.2
Valid N	18102	15319
Mean	.8	16.8
Std. Dev.	2.5	5.7
14		
Median	.9	16.3
Valid N	18073	15269
Mean	1.0	16.9
Std. Dev.	2.5	5.5
15		
Median	.9	16.7
Valid N	18090	15276
Mean	1.2	17.0
Std. Dev.	2.6	5.5
16		
Median	.9	17.1
Valid N	18227	15355
Mean	.9	16.9
Std. Dev.	2.5	5.4
17		
Median	.7	17.3
Valid N	18345	15421
Mean	.6	16.5
Std. Dev.	2.5	5.4
18		
Median	.5	16.1
Valid N	18396	15391
Mean	.4	15.8
Std. Dev.	2.5	5.6
19		
Median		15.0
Valid N	18349	15383
Mean	.3	15.0
Std. Dev.	2.5	5.4
20		
Median		13.1
Valid N	18317	15501
Mean	.1	13.8
Std. Dev.	2.5	5.3
21		
Median	.1	12.0
Valid N	18371	15696
Mean	.0	12.3
Std. Dev.	2.7	4.9
22		
Median		11.4
Valid N	18436	15891
Mean	-.1	11.0
Std. Dev.	2.8	4.6
23		
Median		10.9
Valid N	18486	16045
Mean	-.1	10.1
Std. Dev.	2.9	4.5
24		
Median	.3	10.2
Valid N	18549	16148
Mean	-.2	9.3
Std. Dev.	3.0	4.4

APPENDIX 5

Exposure to each air pollution contaminant
by season and day of week

Sulfur dioxide (µg/m^3)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
winter							
Median	9.0	9.0	9.0	9.0	9.0	9.0	7.0
Valid N	69000	68376	68352	68280	68352	68808	68760
Mean	10.7	10.6	10.2	10.8	10.6	10.4	7.8
Std. Dev.	11.8	9.2	8.5	12.2	9.0	11.0	8.0
summer							
Median	6.0	6.0	6.0	6.0	6.0	5.0	5.0
Valid N	62544	63696	64272	64896	65112	62184	62256
Mean	7.7	7.4	7.5	7.7	7.2	6.1	5.8
Std. Dev.	12.4	13.3	11.2	23.9	9.5	9.1	8.7

Nitrogen dioxide (µg/m^3)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
winter							
Median	14.0	13.0	13.0	14.0	14.0	13.0	12.0
Valid N	69000	68376	68352	68280	68352	68808	68760
Mean	14.9	14.3	14.5	15.5	15.2	14.5	12.2
Std. Dev.	9.4	9.4	10.0	10.8	11.3	9.6	7.7
summer							
Median	12.0	12.0	13.0	13.0	12.0	10.0	10.0
Valid N	62544	63696	64272	64896	65112	62184	62256
Mean	14.5	14.3	14.8	17.0	14.6	12.1	11.9
Std. Dev.	13.5	13.5	13.2	17.3	14.6	11.8	12.4

Nitrogen monoxide (µg/m^3)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
winter							
Median	3.0	3.0	3.0	3.0	2.0	2.0	2.0
Valid N	69000	68376	68352	68280	68352	68808	68760
Mean	15.0	11.6	9.7	13.4	21.4	8.6	6.5
Std. Dev.	43.2	44.8	36.1	43.6	66.8	25.1	17.6
summer							
Median	2.0	2.0	2.0	2.0	2.0	1.0	1.0
Valid N	62544	63696	64272	64895	65112	62184	62256
Mean	5.6	5.8	7.2	10.4	6.9	3.4	3.2
Std. Dev.	32.6	33.5	43.0	55.2	37.1	9.8	13.2

Ozone ($\mu g/m^3$)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
Winter							
Median	4.0	4.0	4.0	1.0	2.0	3.0	7.0
Valid N	69000	68376	68352	68280	68352	68808	68760
Mean	8.2	8.5	8.2	6.9	7.7	7.2	12.5
Std. Dev.	12.6	13.1	12.4	12.9	12.7	11.1	16.0
summer							
Median	21.0	22.0	18.0	17.0	19.0	17.0	16.0
Valid N	62544	63696	64272	64896	65112	62184	62256
Mean	40.8	42.9	33.8	32.9	37.1	39.4	33.4
Std. Dev.	37.3	39.7	31.7	35.7	39.1	42.0	38.2

Carbon monoxide (mg/m^3)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
winter							
Median							
Valid N	65121	64531	64098	64168	63315	61711	61702
Mean	.0	.0	.0	.0	.1	.0	.0
Std. Dev.	.4	.5	.4	.5	.7	.3	.1
summer							
Median							
Valid N	55757	58088	58377	58232	56850	49006	47284
Mean	.0	.0	.1	.1	.0	.0	.0
Std. Dev.	.5	.4	.6	.7	.5	.1	.2

Total chlorine ($\mu g/m^3$)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
winter							
Median	.5	.5	.5	.5	.5	.5	.5
Valid N	69000	68376	68352	68280	68351	68808	68760
Mean	1.4	1.2	1.5	1.3	1.9	2.2	1.4
Std. Dev.	6.0	4.3	3.1	3.4	5.8	6.2	3.6
summer							
Median	.5	.5	.5	.5	.5	.5	.5
Valid N	62544	63696	64272	64896	65112	62184	62256
Mean	.6	.7	.7	.7	.6	.6	.6
Std. Dev.	.5	.7	.8	1.1	.5	.6	.6

Suspended particles - fine fraction (μg/m³)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
winter							
Median	13.0	18.0	14.0	15.0	16.0	11.0	8.0
Valid N	69000	68376	68352	68280	68352	68808	68760
Mean	30.7	32.2	29.8	30.5	31.6	26.0	22.3
Std. Dev.	36.9	35.8	33.6	34.1	35.4	32.4	30.5
summer							
Median	9.0	9.0	10.0	10.0	10.0	7.0	7.0
Valid N	62544	63696	64272	64896	65112	62184	62256
Mean	14.6	14.3	15.9	15.4	15.0	11.7	10.7
Std. Dev.	17.3	15.7	17.6	19.3	16.6	14.8	14.6

Nitrate (μg/m³)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
winter							
Median	.5	.5	.5	.5	.5	.5	.5
Valid N	69000	68376	68352	68280	68352	68808	68760
Mean	.7	.7	.8	.8	.7	.7	.7
Std. Dev.	.4	.3	.6	.9	.5	.5	.4
summer							
Median	.5	.5	.5	.5	.5	.5	.5
Valid N	62544	63696	64272	64896	65112	62184	62256
Mean	.8	.9	1.0	.8	.7	.8	.7
Std. Dev.	.6	.9	1.0	.6	.5	.6	.5

Sulfate (μg/m³)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
winter							
Median	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Valid N	69000	68376	68352	68280	68352	68808	68760
Mean	2.6	3.5	2.5	2.8	2.9	2.8	1.8
Std. Dev.	1.9	3.3	2.0	2.5	2.7	2.5	1.2
summer							
Median	1.0	1.0	2.0	2.0	2.0	2.0	1.0
Valid N	62544	63696	64272	64896	65112	62184	62256
Mean	2.7	2.6	3.1	3.0	3.1	2.9	2.4
Std. Dev.	3.2	2.7	3.2	2.8	3.1	2.8	2.6

Grass pollen (pollen/m³)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
summer							
Median	10.0	10.0	5.0	5.0	5.0	5.0	10.0
Valid N	12107	10892	10135	14374	13449	9027	9922
Mean	57.6	151.0	85.5	18.8	17.5	43.5	60.5
Std. Dev.	115.1	378.4	250.7	47.5	36.3	84.6	149.1

Zero recoded as missing

Birch pollen (pollen/m³)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
summer							
Median	8.0	5.0	10.0	12.0	10.0	10.0	7.0
Valid N	17640	19859	17652	13180	14726	13649	15868
Mean	18.5	19.0	23.1	87.2	34.5	45.3	28.7
Std. Dev.	27.7	28.5	38.1	148.9	55.0	79.7	58.0

Zero recoded as missing

Relative humidity outdoors (per cent)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
winter							
Median	91.0	90.0	92.0	93.0	91.0	90.0	87.0
Valid N	64899	64280	63860	63931	63057	61372	61284
Mean	87.6	84.6	83.1	88.3	86.9	87.0	83.6
Std. Dev.	10.5	13.6	14.3	10.6	11.2	9.6	14.1
summer							
Median	65.0	61.0	75.0	68.0	60.0	65.0	69.0
Valid N	55485	57764	58059	57831	56506	48597	46650
Mean	64.3	63.4	68.0	65.9	63.7	63.2	66.1
Std. Dev.	20.6	21.5	21.9	21.1	20.7	22.4	21.0

Temperature outdoors (degrees C)

	Weekday						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
season							
winter							
Median	.4	-.2	1.5	.7		-.5	-.3
Valid N	64899	64280	63860	63931	63057	61372	61284
Mean	.2	.1	.6	.5	-.4	-1.3	.1
Std. Dev.	2.3	2.2	3.1	3.2	3.4	3.1	2.8
summer							
Median	13.1	12.6	12.0	11.9	12.9	12.2	13.5
Valid N	55485	57764	58059	57831	56506	48597	46650
Mean	13.4	12.5	12.1	12.7	12.8	12.8	12.8
Std. Dev.	5.8	5.8	5.5	6.6	6.8	6.5	6.3

APPENDIX 6

Exposure to each air pollution
contaminant by season and type of location

Sulfur dioxide (µg/m3)

	Type of location							
	Not relevant	Home/ Office	Shop	Industrial area	Coffee shop, Restaurant etc. with smoking	Movie, Sports-hall etc without smoking	School, Day Case Center	Other
season								
winter								
Median	10.0	9.0	11.0	10.0	9.0	9.0	10.0	6.0
Valid N	15693	377224	4348	20709	2129	4792	9709	19895
Mean	14.1	10.4	12.7	12.3	11.0	11.2	11.3	6.4
Std. Dev.	14.0	9.9	10.3	9.6	12.2	16.1	7.5	8.4
summer								
Median	5.0	6.0	8.0	7.0	6.0	6.0	7.0	.5
Valid N	15102	324740	3821	17553	2162	2769	8002	28504
Mean	7.2	7.9	10.8	8.4	7.1	7.6	7.7	3.2
Std. Dev.	10.2	15.0	11.3	8.9	10.7	8.0	5.5	7.7

Nitrogen dioxide (µg/m3)

	Type of location							
	Not relevant	Home/ office	Shop	Industrial area	Coffee shop, Restaurant etc, with smoking	Movie, sports-hall etc without smoking	School, Day Case Center	Other
season								
winter								
Median	25.0	13.0	16.0	16.0	15.0	16.0	15.0	12.0
Valid N	15693	377224	4348	20709	2129	4792	9709	19895
Mean	28.6	14.3	17.5	19.1	17.0	15.8	17.0	9.6
Std. Dev.	19.3	8.3	7.7	11.5	9.3	7.1	6.8	10.2
summer								
Median	13.0	13.0	12.0	13.0	13.0	13.0	11.0	.5
Valid N	15102	324740	3821	17553	2162	2769	8002	28504
Mean	20.5	15.8	15.3	17.0	15.6	14.8	12.9	5.4
Std. Dev.	27.0	12.9	12.5	15.8	13.8	12.0	8.4	9.7

Nitrogen monoxide (µg/m3)

	Type of location							
	Not relevant	Home/ Office	Shop	Industrial area	Coffee shop, Restaurant etc. with smoking	Movie, Sports-hall etc without smoking	School, Day Case Center	Other
season								
winter								
Median	10.0	2.0	7.0	8.0	4.0	4.0	6.0	1.0
Valid N	15693	377224	4348	20709	2129	4792	9709	19895
Mean	48.5	10.0	24.6	29.2	17.7	15.2	15.1	8.9
Std. Dev.	120.6	31.5	60.9	76.2	50.6	29.3	34.4	37.1
summer								
Median	2.0	2.0	3.0	3.0	2.0	2.0	3.0	.5
Valid N	15102	324739	3821	17553	2162	2769	8002	28504
Mean	19.5	5.6	12.3	13.3	5.2	5.3	5.6	3.0
Std. Dev.	88.1	29.9	53.7	61.5	27.8	26.8	24.3	25.9

Ozone (µg/m³)

	Type of location							
	Not relevant	Home/ Office	Shop	Industrial area	Coffee shop, Restaurant etc. with smoking	Movie, Sports-hall etc without smoking	School, Day Case Center	Other
season								
winter								
Median	13.0	5.0	1.0	2.0	2.0	2.0	2.0	.5
Valid N	15693	377224	4348	20709	2129	4792	9709	19895
Mean	18.7	9.0	4.2	5.5	5.8	4.8	4.3	3.6
Std. Dev.	19.5	13.4	5.9	9.4	9.2	7.1	6.1	7.7
summer								
Median	82.0	22.0	19.0	20.0	23.0	18.0	20.0	.5
Valid N	15102	324740	3821	17553	2162	2769	8002	28504
Mean	78.3	40.4	30.7	38.0	43.6	32.3	37.7	15.7
Std. Dev.	34.2	37.2	30.5	35.3	41.3	34.8	36.2	30.2

Total chlorine (µg/m³)

	Type of location							
	Not relevant	Home Office	Shop	Industrial area	Coffee shop, Restaurant etc. with smoking	Movie, Sports-hall etc without smoking	School Day Center	Other
season								
winter								
Median	.5	.5	.5	.5	.5	.5	.5	.5
Valid N	15693-	*****	4348	20709	2129	4792	9709	19895
Mean	1.8	1.6	1.2	3.1	1.2	1.2	1.2	.9
Std. Dev.	3.8	4.7	2.3	9.8	2.1	2.4	3.3	2.3
summer								
Median	.5	.5	.5	.5	.5	.5	.5	.5
Valid N	15102	*****	3821	17553	2162	2769	8002	28504
Mean	.6	.7	.6	.7	.6	.6	.6	.5
Std. Dev.	.4	.8	.2	.9	.5	.3	.4	.2

Suspended particles - fine fraction (µg/m³)

	Type of location							
	Not relevant	Home/ Office	Shop	Industrial area	Coffee shop, Restaurant etc. with smoking	Movie, Sports-hall etc without smoking	School, Day case Center	Other
season								
winter								
Median	14.0	13.0	45.0	49.0	50.0	44.0	40.0	7.0
Valid N	15693	377224	4348	20709	2129	4792	9709	19895
Mean	18.5	27.8	53.6	59.8	63.1	48.4	42.4	28.7
Std. Dev.	15.7	33.1	39.3	41.9	40.8	34.5	34.9	37.2
summer								
Median	10.0	10.0	16.0	19.0	15.0	13.0	12.0	.5
Valid N	15102	324740	3821	17553	2162	2769	8002	28504
Mean	13.6	14.7	23.0	28.7	23.0	16.9	18.0	7.7
Std. Dev.	11.5	16.4	18.6	23.7	20.3	16.2	16.7	14.7

Birch pollen (pollen/m^3)

	Type of location							
	Not relevant	Home/ Office	Shop	Industrial area	Coffee shop, Restaurant etc. with smoking	Movie, Sports-hall etc without smoking	School, Day case Center	Other
season								
summer								
Median	14.0	10.0	5.0	5.0	9.0	5.0	5.0	5.0
Valid N	5248	91000	1132	5207	582	673	2509	3198
Mean	44.4	35.8	13.4	17.5	27.7	19.0	14.6	27.4
Std. Dev.	61.6	75.9	27.2	35.6	47.7	37.9	29.3	63.8

Zero recoded as missing

Grass pollen (pollen/m^3)

	Type of location							
	Not relevant	Home/ Office	Shop	Industrial area	Coffee shop Restaurant etc. with smoking	Movie, Sports-hall etc without smoking	School, Day Case Center	Other
season								
summer								
Median	10.0	5.0	5.0	7.0	5.0	5.0	5.0	5.0
Valid N	3516	63084	1085	4951	380	457	1859	2525
Mean	65.0	60.6	38.7	56.2	32.7	48.8	36.5	53.0
Std. Dev.	143.4	201.6	98.3	127.4	82.9	131.0	96.6	143.6

Zero recoded as missing

Temperature outdoors (degrees C)

	Type of location							
	Not relevant	Home/ Office	Shop	Industrial area	Coffee shop, Restaurant etc. with smoking	Movie, Sports-hall etc without smoking	School, Day case Center	Other
season								
winter								
Median	.5		.5	.3		.2	.5	.2
Valid N	15671	368623	4276	20592	1993	4342	9670	10650
Mean	.5	-.1	.5	.4	.0	.3	.6	.3
Std. Dev.	2.6	3.0	2.6	2.8	2.7	2.7	2.6	2.7
summer								
Median	15.1	12.0	15.6	15.1	13.1	13.5	13.7	14.6
Valid N	15102	313423	3790	17437	2030	2359	7911	10018
Mean	15.7	12.2	16.1	15.4	13.5	13.8	14.5	15.0
Std. Dev.	5.5	6.1	5.8	5.9	6.2	6.0	5.6	5.9

APPENDIX 7

Exposure to each air pollution contamination
by population subgroup and month

Sulfur dioxide (µg/m³)

	Month					
	January	February	March	April	May	June
SUBGROUPS						
Adults - randomly chosen						
Median	9.0	9.0	7.0	6.0	6.0	5.0
Valid N	151224	195408	34800	37872	185736	127824
Mean	10.5	10.4	8.4	8.0	7.6	6.3
Std. Dev.	9.1	11.0	8.3	9.1	16.5	10.3
Children - lung disease						
Median	9.0	8.0	7.0	7.0	6.0	5.0
Valid N	8952	10632	1632	1656	10416	7272
Mean	9.5	9.9	7.7	10.3	7.5	6.2
Std. Dev.	6.1	10.6	8.0	14.6	11.8	11.9
Adults - lung disease						
Median	9.0	8.0	7.0	6.0	6.0	5.0
Valid N	33240	39984	4056	6816	38832	28536
Mean	9.8	10.0	8.4	7.6	6.9	5.7
Std. Dev.	9.4	11.4	10.2	10.7	13.9	10.1

Nitrogen monoxide (µg/m³)

	Month					
	January	February	March	April	May	June
SUBGROUPS						
Adults - randomly chosen						
Median	3.0	3.0	1.0	1.0	2.0	1.0
Valid N	151224	195408	34800	37872	185736	127824
Mean	15.6	11.3	7.3	5.5	6.8	5.6
Std. Dev.	48.6	38.7	41.2	32.3	35.3	36.6
Children - lung disease						
Median	2.0	2.0	1.0	2.0	2.0	1.0
Valid N	8952	10632	1632	1656	10416	7272
Mean	11.1	8.3	5.7	5.3	5.0	3.2
Std. Dev.	39.5	30.8	35.1	28.3	21.1	12.1
Adults - lung disease						
Median	2.0	2.0	1.0	1.0	2.0	1.0
Valid N	33240	39984	4056	6816	38832	28535
Mean	14.3	9.8	6.9	5.9	6.3	5.3
Std. Dev.	44.3	36.5	43.2	42.4	36.6	41.7

Nitrogen dioxide (μg/m³)

	Month					
	January	February	March	April	May	June
SUBGROUPS						
Adults - randomly chosen						
Median	14.0	13.0	12.0	13.0	13.0	11.0
Valid N	151224	195408	34800	37872	185736	127824
Mean	15.5	14.1	13.2	14.7	15.0	13.7
Std. Dev.	10.3	8.9	11.8	12.7	14.1	13.9
Children - lung disease						
Median	14.0	12.0	10.0	13.0	11.0	10.0
Valid N	8952	10632	1632	1656	10416	7272
Mean	15.0	13.1	11.9	16.5	14.2	11.9
Std. Dev.	9.1	8.6	11.9	15.0	13.1	11.1
Adults - lung disease						
Median	13.0	12.0	9.0	11.0	10.0	9.0
Valid N	33240	39984	4056	6816	38832	28536
Mean	14.9	13.2	11.9	13.9	13.7	11.9
Std. Dev.	11.0	9.2	11.8	15.6	15.0	14.1

Ozone (μg/m³)

	Month					
	January	February	March	April	May	June
SUBGROUPS						
Adults - randomly chosen						
Median	1.0	4.0	9.0	15.0	18.0	26.0
Valid N	151224	195408	34800	37872	185736	127824
Mean	7.0	8.4	14.2	27.6	37.5	38.8
Std. Dev.	12.3	12.2	18.2	28.0	41.1	34.4
Children - lung disease						
Median	2.0	4.0	9.0	16.0	17.0	18.0
Valid N	8952	10632	1632	1656	10416	7272
Mean	6.5	7.6	13.7	29.6	36.5	37.8
Std. Dev.	11.1	11.1	18.4	29.6	41.5	36.3
Adults - lung disease						
Median	1.0	5.0	11.0	17.0	19.0	26.0
Valid N	33240	39984	4056	6816	38832	28536
Mean	7.8	9.2	17.2	33.2	39.2	39.1
Std. Dev.	13.6	13.1	19.8	32.4	42.5	35.5

Carbon monoxide (mg/m^3)

	Month					
	January	February	March	April	May	June
SUBGROUPS						
Adults - randomly chosen						
Median	2.0	2.0	2.0	2.0	2.0	2.0
Valid N	1599	1827	338	365	1854	1452
Mean	3.6	3.3	3.5	3.3	3.4	3.3
Std. Dev.	3.2	3.0	3.6	2.9	3.0	3.0
Children - lung disease						
Median	2.0	3.0	3.0	3.0	2.0	2.0
Valid N	50	45	9	11	53	36
Mean	2.9	3.7	4.0	3.3	2.6	1.8
Std. Dev.	2.2	2.6	3.3	2.6	2.5	.9
Adults - lung disease						
Median	2.0	2.0	4.5	3.0	2.0	2.0
Valid N	311	313	36	64	341	288
Mean	2.8	3.2	5.6	3.7	3.3	3.5
Std. Dev.	2.4	2.9	6.1	3.3	3.1	3.3

Suspended particles - fine fraction ($\mu g/m^3$)

	Month					
	January	February	March	April	May	June
SUBGROUPS						
Adults - randomly chosen						
Median	15.0	14.0	11.0	9.0	10.0	9.0
Valid N	151224	195408	34800	37872	185736	127824
Mean	31.1	30.9	28.6	15.6	15.2	13.1
Std. Dev.	35.9	35.2	36.1	18.0	17.0	16.9
Children - lung disease						
Median	16.0	16.0	14.0	12.0	9.0	8.0
Valid N	8952	10632	1632	1656	10416	7272
Mean	22.8	23.4	24.7	17.1	13.3	12.0
Std. Dev.	23.1	24.2	26.9	16.9	15.3	16.7
Adults - lung disease						
Median	10.0	10.0	8.0	7.0	8.0	7.0
Valid N	33240	39984	4056	6816	38832	28536
Mean	22.4	21.7	16.5	11.9	12.3	10.6
Std. Dev.	29.6	28.2	22.9	14.8	14.8	14.8

Grass pollen (pollen/m^3)

	Month		
	April	May	June
SUBGROUPS			
Adults - randomly chosen			
Median	.	5.0	10.0
Valid N		13196	49759
Mean	.	5.3	72.2
Std. Dev.	.	4.5	208.7
Children - lung disease			
Median	.	3.0	7.0
Valid N		798	2872
Mean	.	4.4	63.4
Std. Dev.	.	4.2	187.4
Adults - lung disease			
Median	.	5.0	10.0
Valid N		2686	10595
Mean	.	5.6	79.6
Std. Dev.	.	4.5	219.3

Zero recoded as missing

Birch pollen (pollen/m^3)

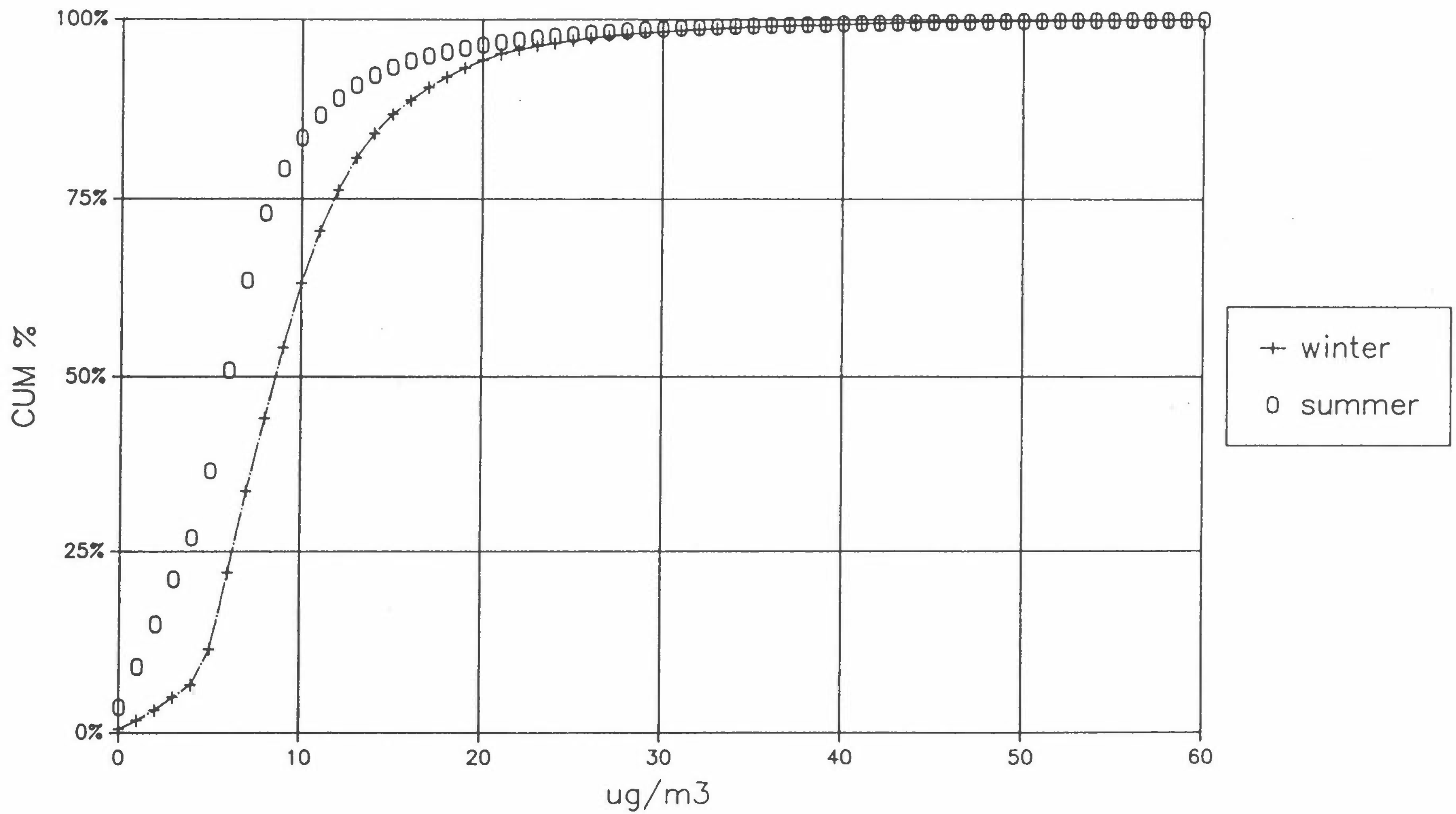
	Month		
	April	May	June
SUBGROUPS			
Adults - randomly chosen			
Median	1.0	10.0	5.0
Valid N	576	76624	12097
Mean	2.5	39.0	6.2
Std. Dev.	1.9	77.0	5.9
Children - lung disease			
Median	1.0	9.0	5.0
Valid N	37	4421	751
Mean	1.9	30.2	5.3
Std. Dev.	1.7	62.7	5.4
Adults - lung disease			
Median	5.0	10.0	5.0
Valid N	116	15455	2497
Mean	3.0	40.6	6.4
Std. Dev.	2.0	78.6	6.0

Zero recoded as missing

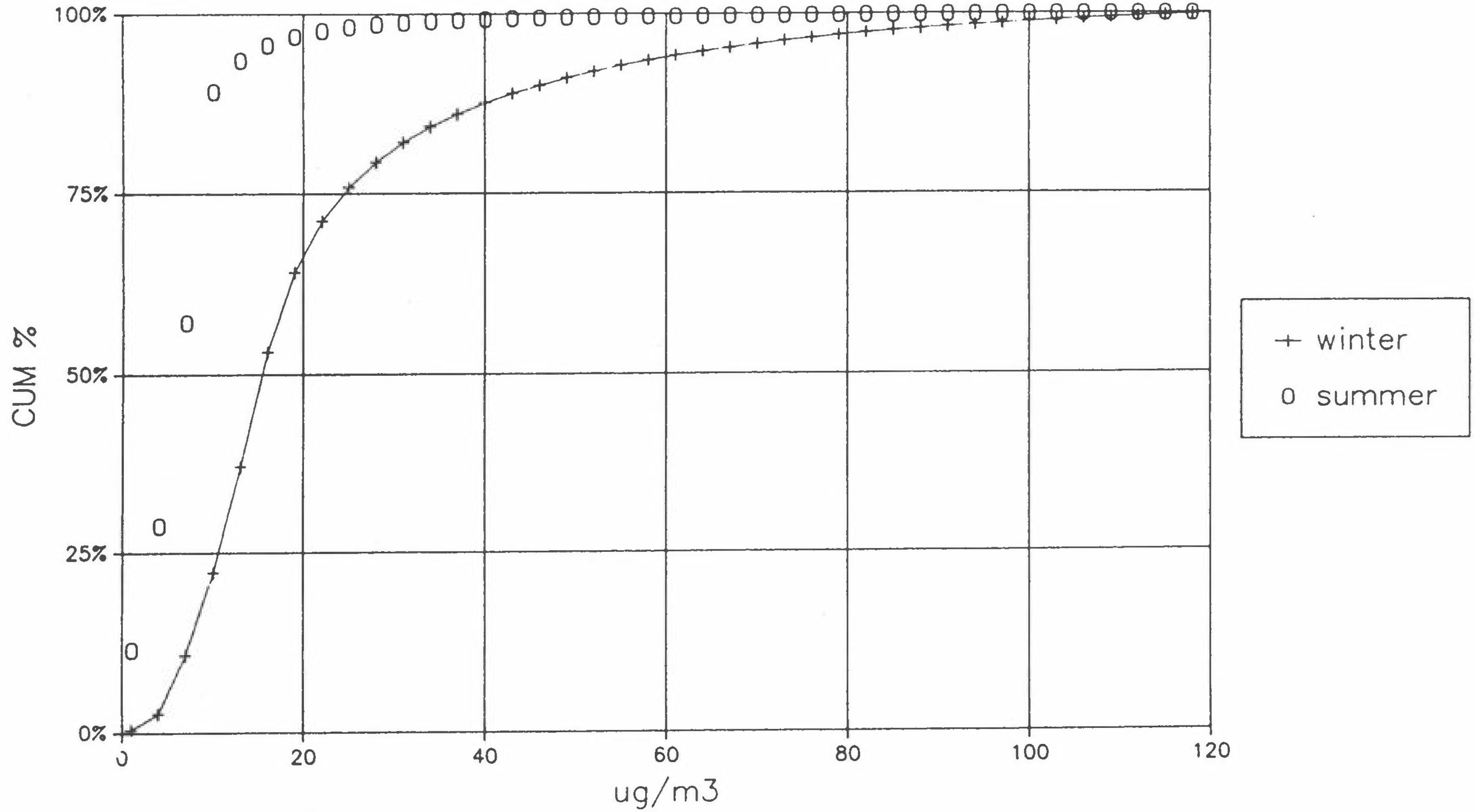
APPENDIX 8

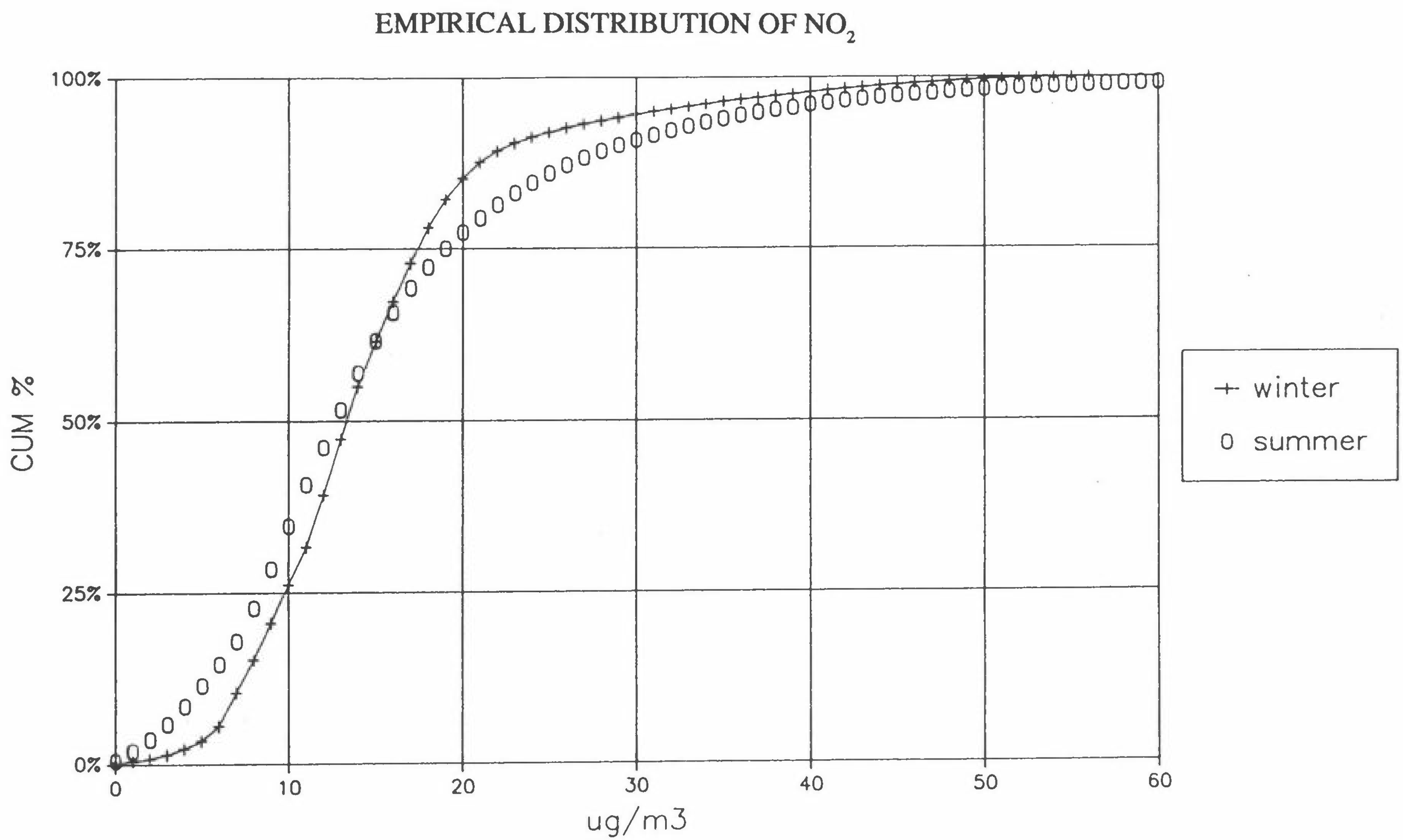
Cumulative frequency distribution
of each air pollution contaminant

EMPIRICAL DISTRIBUTION OF SO_2

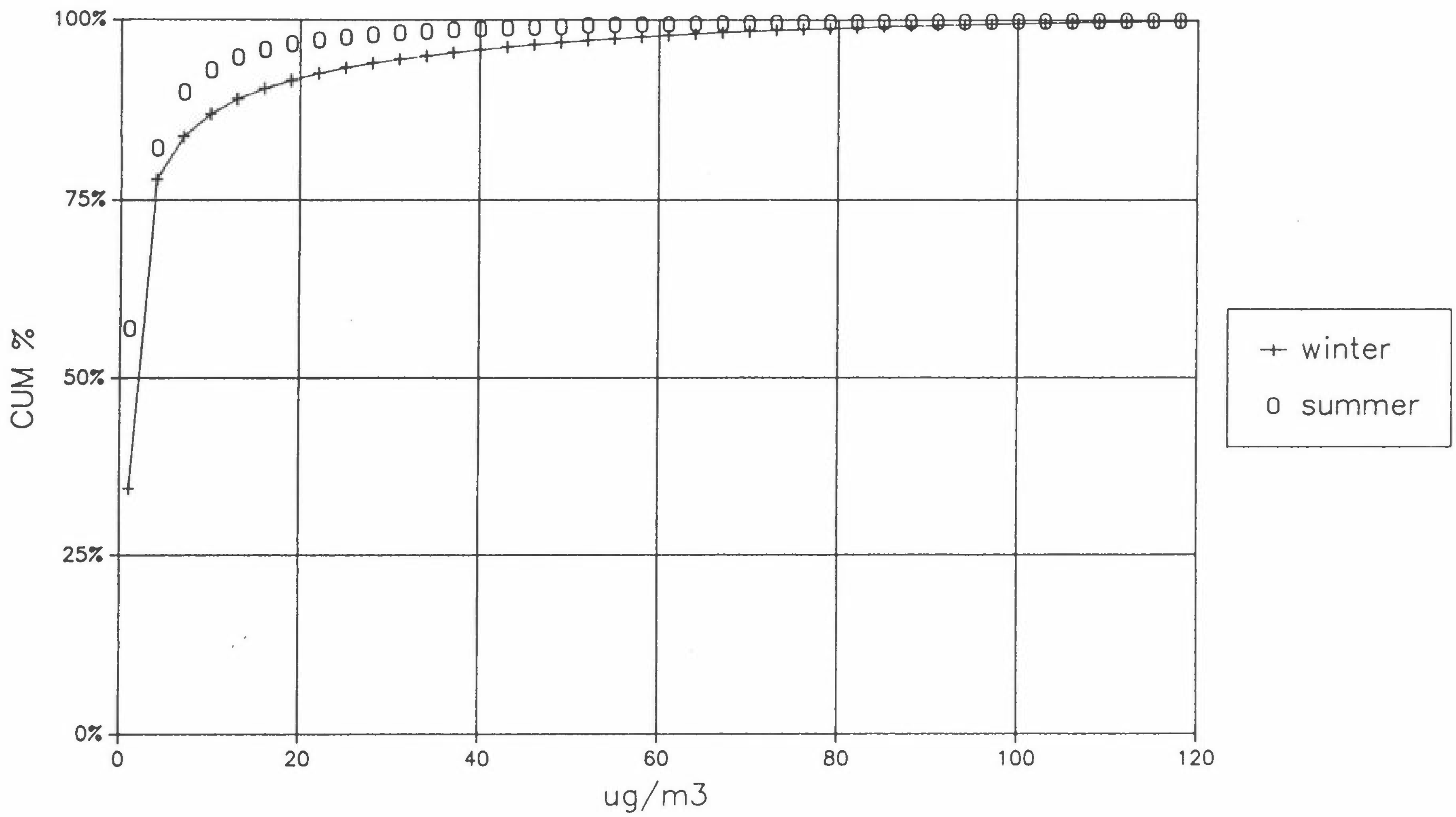


EMPIRICAL DISTRIBUTION OF NO_x

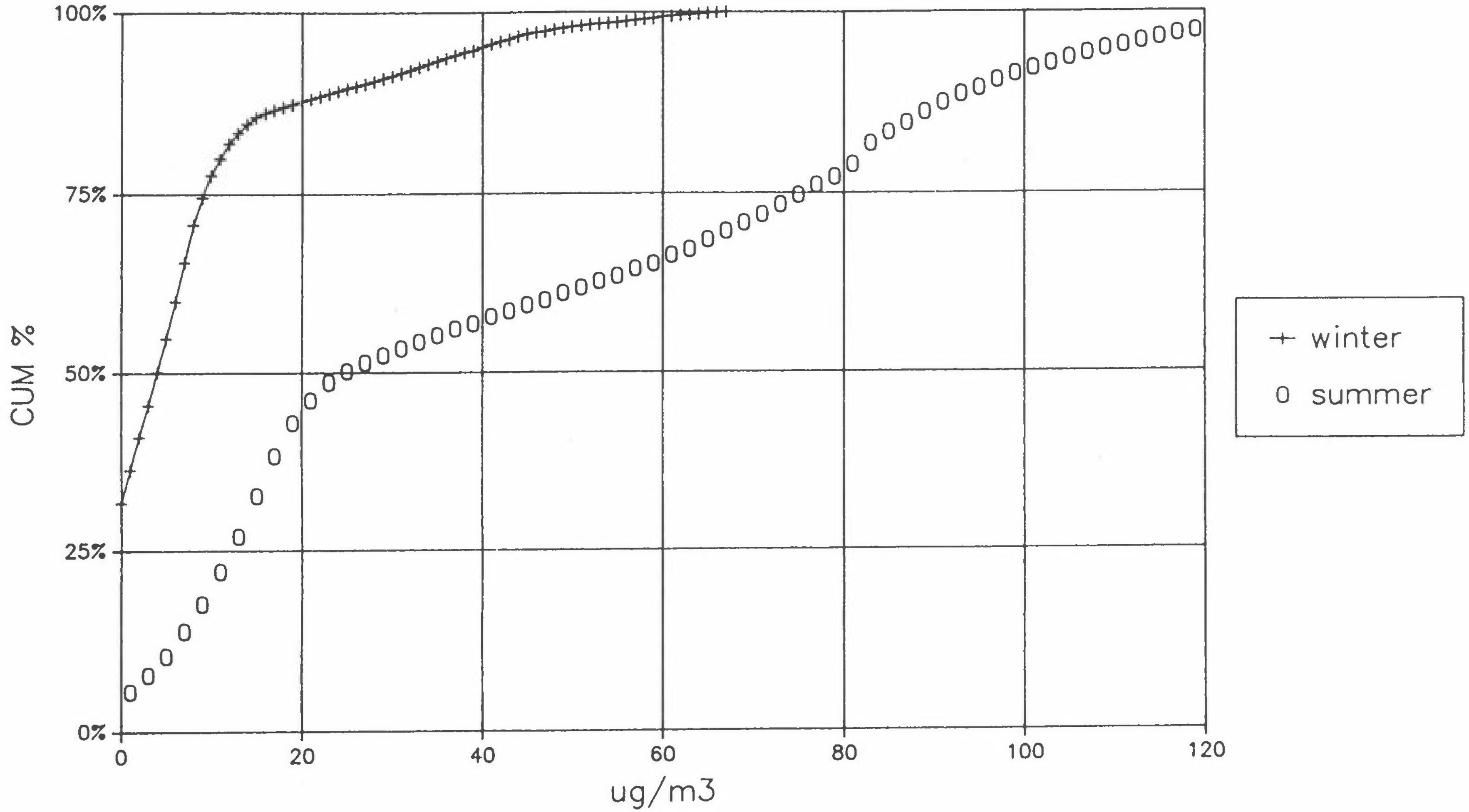



EMPIRICAL DISTRIBUTION OF NO2
CUM %
100%
75%
50%
25%
0%
0
10
20
30
40
50
60
ug/m3
+ winter
0 summer

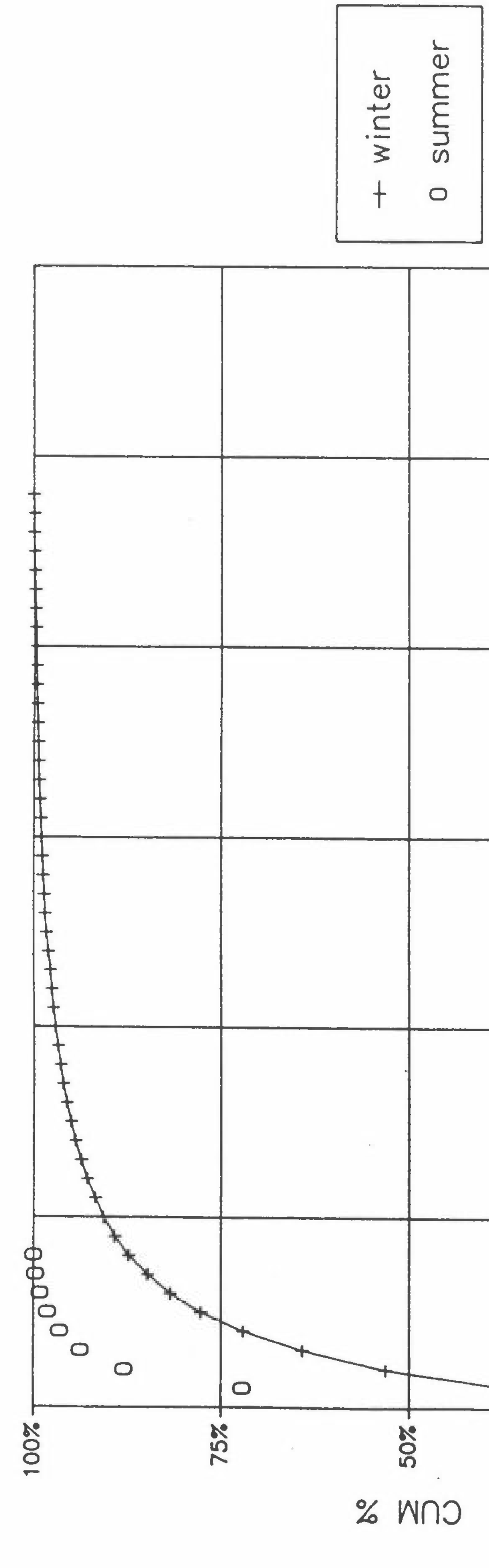
EMPIRICAL DISTRIBUTION OF NO



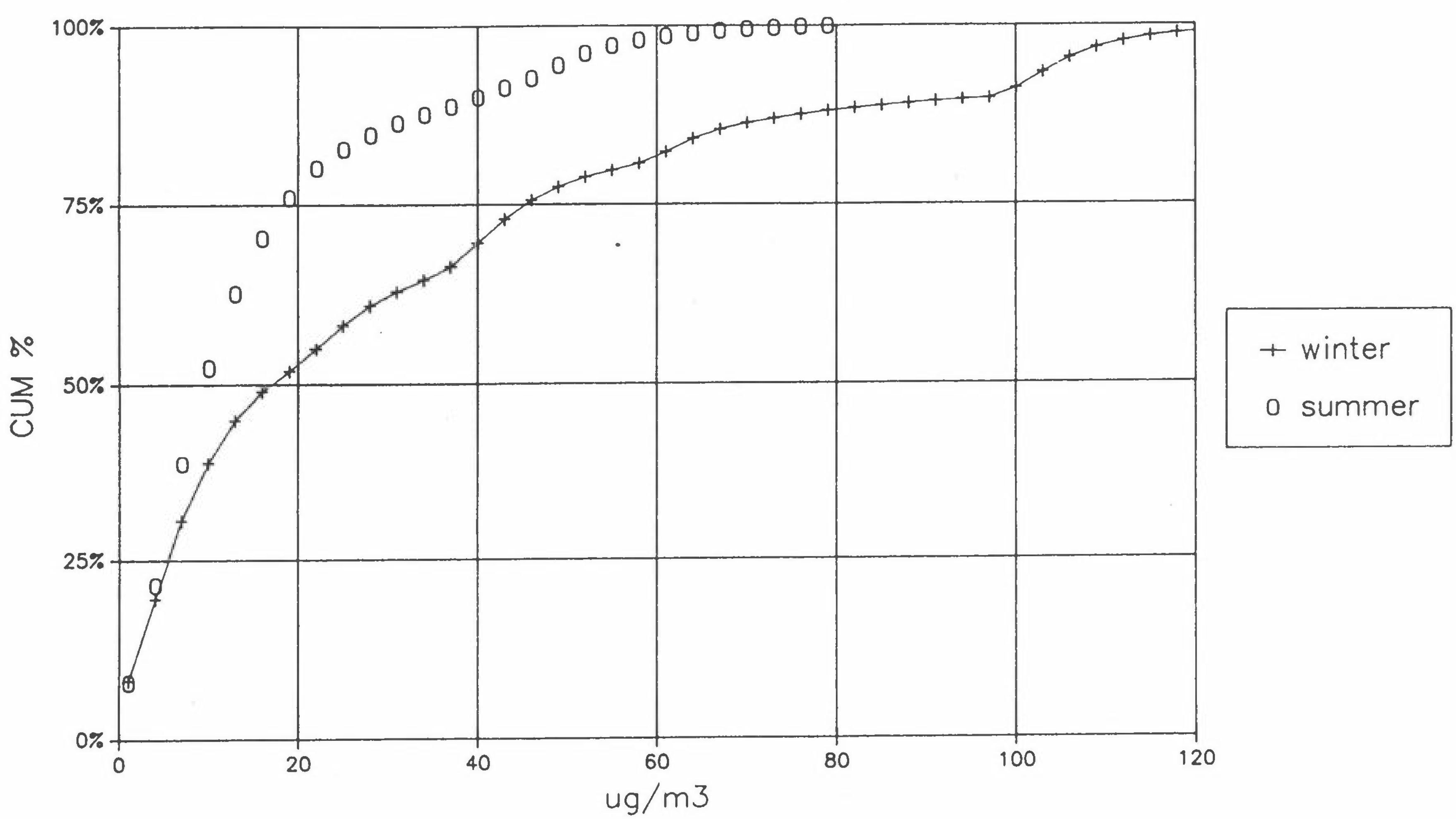
EMPIRICAL DISTRIBUTION OF O_3

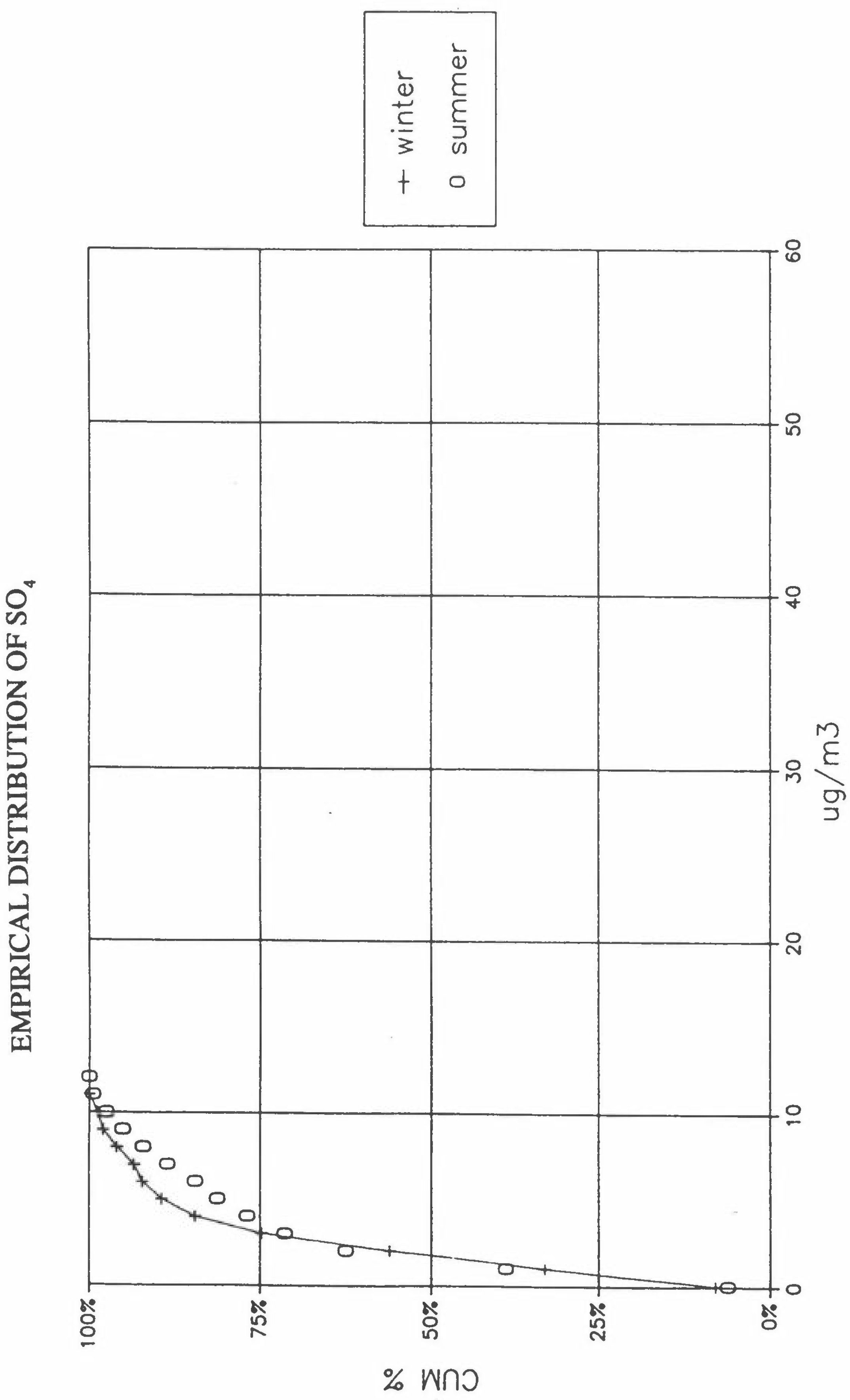


EMPIRICAL DISTRIBUTION OF Cl_x



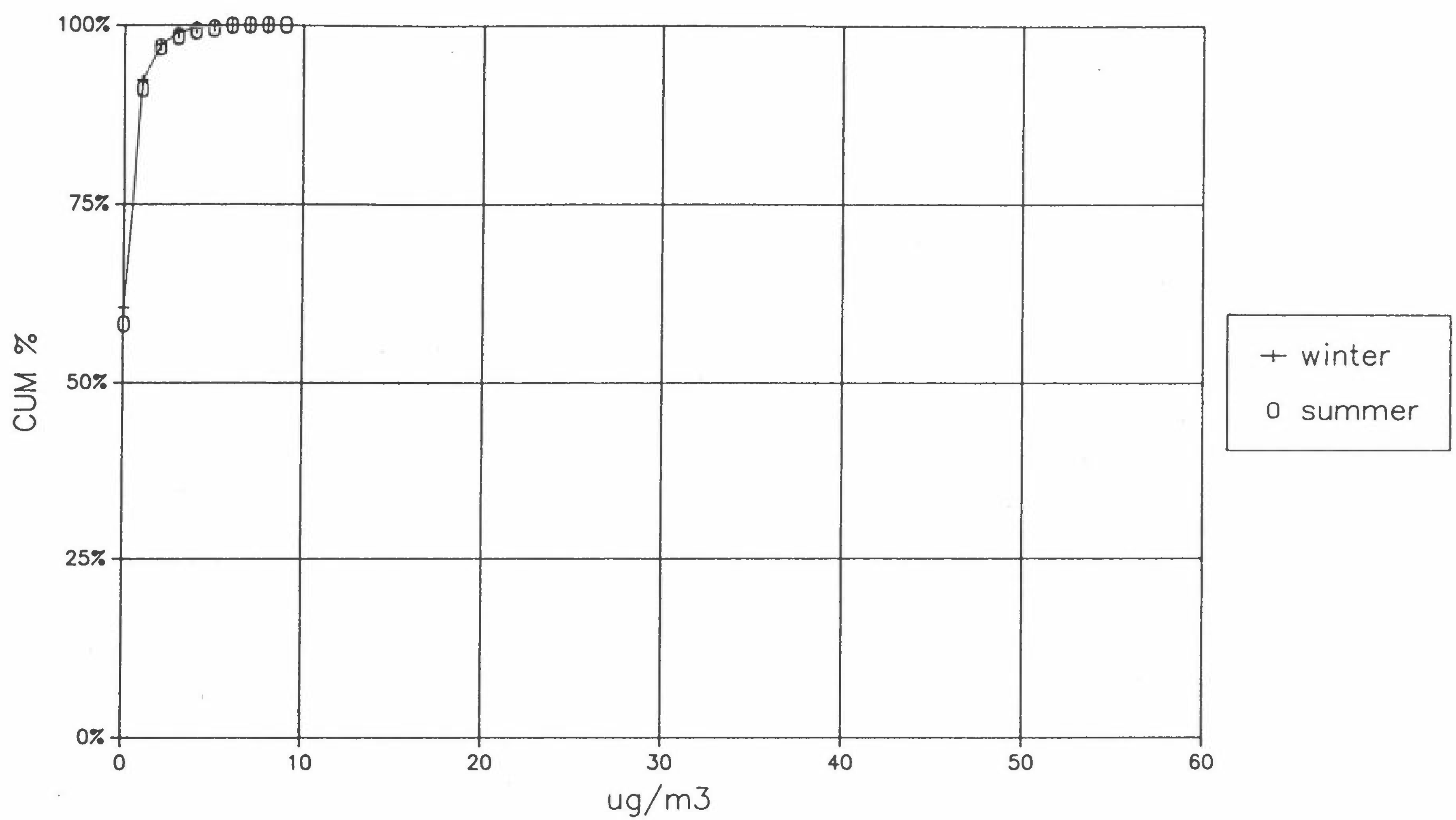
EMPIRICAL DISTRIBUTION OF PARTICLES - FINE FRACTION





EMPIRICAL DISTRIBUTION OF SO_4
+ winter
o summer
CUM %
100%
75%
50%
25%
0%
0
10
20
30
40
50
60
ug/m3

EMPIRICAL DISTRIBUTION OF NO_3



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TITTEL Air pollution and short-term health effects in an industrialized area in Norway. Estimating individual air pollution exposure.		PROSJEKTLEDER J. Clench-Aas NILU PROSJEKT NR. O-8747	
FORFATTER(E) J. Clench-Aas, A. Harstad, M.J. Aarnes, A. Bartonova, O.A. Braathen, K.E. Grønskei, L.O. Hagen		TILGJENGELIGHET * A OPPDRAGSGIVERS REF.	

OPPDRAGSGIVER (NAVN OG ADRESSE)
Norwegian Ministry of Environment, Norwegian State Pollution Control Authority, Royal Council for Scientific and Industrial Research, Norwegian Research Council for Science and the Humanities

3 STIKKORD (a maks. 20 anslag)

Air pollution exposure	time-budget	cohort investigation

REFERAT (maks. 300 anslag, 7 linjer)
Rapporten beskriver de forskjellige delene av en modell som beregner individuel eksponering av SO_2, NO_2, O_3, partikler, sulfat, nitrat og klor, time for time for rundt 400 individer i rundt 120 dager. Den beskriver i tillegg forskjellen i bruk av tid av flere befolkningsgrupper og deres eksponering for de komponentene.

TITLE

ABSTRACT (max. 300 characters, 7 lines)
This report describes the elements that entered into a model to estimate individual exposure to SO_2, NO_2, O_3, particles, sulfates, nitrates and chlorine for 400 individuals on an hourly basis, for around 120 days. It also describes trends in time-budget of groups of individuals and trends in exposure to the compounds.

* Kategorier:		
	Åpen - kan bestilles fra NILU	A
	Må bestilles gjennom oppdragsgiver	B
	Kan ikke utleveres	C