Report to the EU-Commission

concerning exceedances of the Ozone Target Values in Belgium for the year 2004

December 2006 version 6

Content

This report has been made by the Belgian Interregional Environment Agency CELINE-IRCEL on behalf of the 3 Belgian Regions.

CELINE-IRCEL
Kunstlaan 10/11
B-1210 Brussels
www.irceline.be
December 2006

According to Article 10 (1) (b) of the Directive 2002/3/EC relating to ozone in ambient air:

Article 10

1. When forwarding information to the Commission under Article 11 of Directive 96/62/EC, Member States shall also, and, for the first time, for the calendar year following the date referred to in Article 15(1):

(a) ….

(b) send to the Commission a report giving an overview of the situation as regards exceedance of the target values as laid down in section II of Annex I. This report shall provide an explanation of annual exceedances of the target value for the protection of human health. The report shall also contain the plans and programmes referred to in Article 3(3). The report shall be sent no later than two years after the end of the period during which exceedances of the target values for ozone were observed.

referring to Article 3 (3)

Article 3

1. The target values for 2010 in respect of ozone concentrations in ambient air are those set out in Section II of Annex I.

2. Member States shall draw up a list of zones and agglomerations in which the levels of ozone in ambient air, as assessed in accordance with Article 9, are higher than the target values referred to in paragraph 1.

3. For the zones and agglomerations referred to in paragraph 2, Member States shall take measures to ensure, in accordance with the provisions of Directive 2001/81/EC, that a plan or programme is prepared and implemented in order to attain the target value, save where not achievable through proportionate measures, as from the date specified in Section II of Annex I.

Where, in accordance with Article 8(3) of Directive 96/62/EC, plans or programmes must be prepared or implemented in respect of pollutants other than ozone, Member States shall, where appropriate, prepare and implement integrated plans or programmes covering all the pollutants concerned.

4. The plans or programmes, referred to in paragraph 3, shall incorporate at least the information listed in Annex IV to Directive 96/62/EC and shall be made available to the public and to appropriate organisations such as environmental organisations, consumer organisations, organisations representing the interests of sensitive population groups and other relevant health care bodies.

referring to Annex IV to the Directive 96/62/EC (see annex 3 to this report)

Belgium reports hereby on the exceedances of target values for ozone for the year 2004

Target values for ozone as laid down in Section II of Annex I of the Directive 2002/3/EC are given in annex 2 to this report and can be summarized as follows:

	Parameter	Target value for 2010
1. Target value for the protection of human health	Maximum daily 8-hour mean	120 µg/m³ not to be exceeded on more than 25 days per calendar year averaged over three years
2. Target value for the protection of vegetation	AOT40, calculated from 1h values from May to July	18 000 µg/m³.h averaged over five years

Chapter 1: Overview of the situation as regards exceedance of the target values for the year 2004

1.1 Methodology

1.1.1 Measuring stations and techniques for monitoring ozone in ambient air in Belgium

All ozone monitors in the telemetric networks of the Belgian Regions are monitors based on UV-photometry. 37 ozone monitoring stations were operational during the 2000-2004 period. 7 are located in the Brussels-Capital Region, 18 in Flanders and 12 in Wallonia.

Station Code	location	Latitude	Longitude	% available data over the 3 year period 2002 - 2004	% available data over the 5 year period 2000 - 2004
Brussels-Capital					
41B004	Brussel (Sint-Katelijne)	50.85136	4.34732	96%	78%
41B006	Brussel (EU parlement)	50.83918	4.37312	96%	63%
41B011	Sint-Agatha-Berchem	50.85857	4.28707	96%	94%
41N043	Haren (Brussel)	50.8841	4.3817	94%	94%
41R001	Sint-Jans-Molenbeek	50.85021	4.33255	95%	95%
41R012	Ukkel	50.79718	4.35727	95%	94%
41WOL1	Sint-Lambrechts-Woluwe	50.85712	4.42444	92%	78%
Flanders					
42N016	Dessel	51.23419	5.16268	89%	89%
42N035	Aarschot	50.97809	4.83634	91%	91%
42N040	Sint-Pieters-Leeuw	50.76868	4.22393	90%	90%
42N045	Hasselt	50.94026	5.36708	53%	32%
42N046	Gellik (Lanaken)	50.88285	5.61729	87%	86%
42N054	Walshoutem (Landen)	50.71226	5.10187	90%	90%
42R801	Borgerhout	51.2102	4.43055	88%	89%
42R811	Schoten	51.25264	4.49009	55%	33%
42R831	Berendrecht (Antwerpen)	51.34933	4.33844	91%	89%
42R841	Mechelen	51.0019	4.47055	50%	30%
44M705	Roeselare	50.945	3.15361	89%	90%
44N012	Moerkerke (Damme)	51.25333	3.36361	91%	91%
44N029	Houtem (Veurne)	51.0168	2.5812	88%	89%
44N050	Sint-Denijs (Zwevegem)	50.75222	3.36944	73%	80%
44N051	Idegem (Geraardsbergen)	50.79946	3.92904	91%	91%
44R701	Gent	51.05887	3.72805	91%	92%
44R710	Destelbergen	51.06181	3.77401	55%	33%
44R740	Sint-Kruis-Winkel (Gent)	51.15067	3.80748	90%	90%
Wallonia					
43N066	Eupen	50.62942	6.00102	92%	93%
43N070	Mons	50.46575	3.93847	93%	93%
43N073	Vezin (Andenne)	50.50327	4.98714	92%	93%
43N085	Vielsalm	50.30378	6.00043	89%	90%
43N093	Sinsin (Somme-Leuze)	50.27504	5.23389	91%	92%
43N100	Dourbes (Viroinval)	50.09601	4.59347	86%	88%
43N113	Sainte-Ode	50.0276	5.59173	90%	91%
43N121	Offagne (Paliseul)	49.87771	5.20111	92%	93%
43N132	Habay-la-Neuve (Habay)	49.71987	5.62911	90%	90%
43R201	Liège	50.62913	5.57382	92%	90%

43R240	Engis	50.58417	5.39616	89%	91%
45R502	Lodelinsart (Charleroi)	50.42955	4.45742	89%	89%

1.1.2 Quality assurance and quality control of ozone monitoring

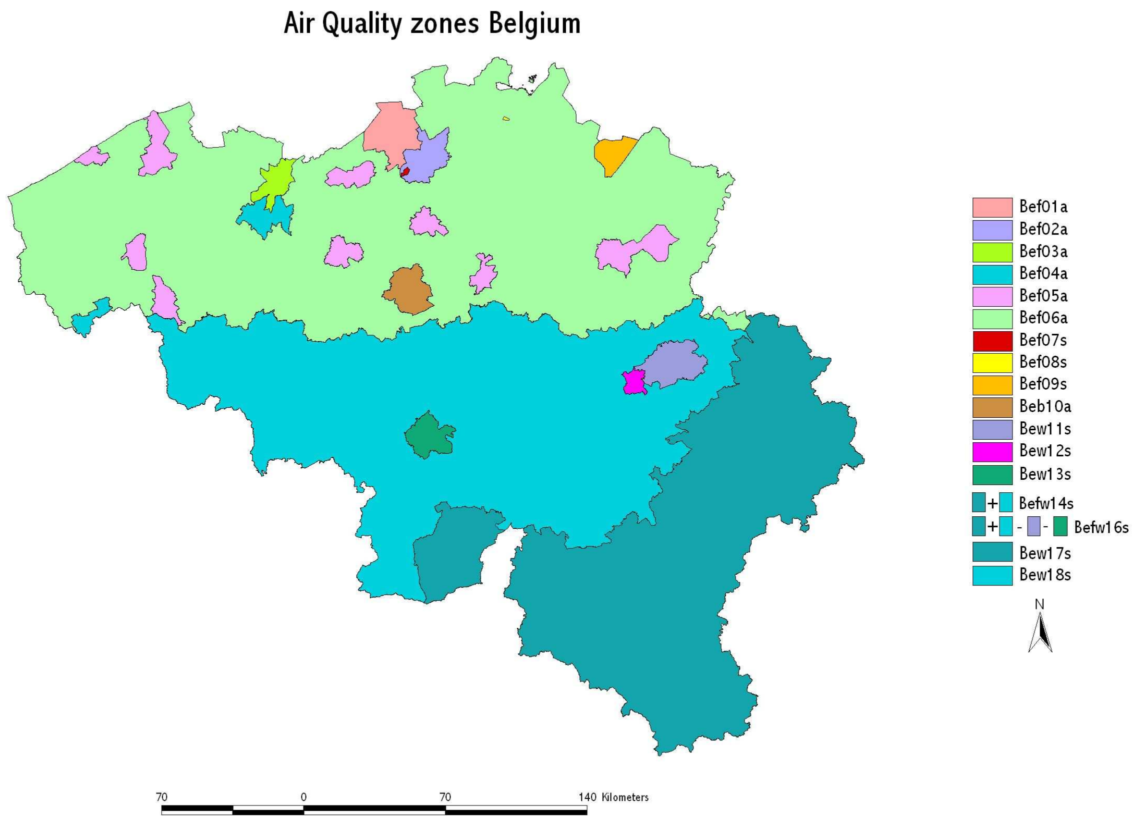
According to the EU Directive 2002/3/EC relating to ozone in ambient air, the reference method for analysis of ozone and calibration of ozone instruments is that described in EN 14625:2005. This reference method assigns the UV photometric method for the analysis and the primary UV calibration photometer for the calibration according to ISO 13964 (1998).
Twice a year -once before and once after the summer period- all ozone monitors used in the telemetric networks of the 3 Belgian Regions are physically brought to the Interregional Calibration Bench (at IRCEL-CELINE) for an in-depth check up and recalibration against the primary UV-photometer. This check-up consists first of all of a verification of the status, followed by a maintenance and finally a recalibration before the monitor is re-installed into the network. Deviations observed during the first control test give an idea about the accuracy of the measurements since the last calibration procedure was performed. During these first control linearity is also checked and leak and stability tests are performed.
Between two visits at the central calibration bench, all network analyzers are controlled in the field by means of daily zero/span checks provided by an internal ozone generator. Casual field checks are performed with a calibrated portable ozone generator
The primary UV-photometer in its turn is calibrated each year against the NIST-photometer SRP-24 from the LNE (Laboratoire national de métrologie et d’essais) in Paris, which delivers the calibration certificate. The reliability of the IRCEL-CELINE -reference standard is regularly verified in international intercomparison exercises organised by ao JRC (Ispra) or the WHO.
The results of the early spring tests in 2004 at the calibration bench showed 13 of the 18 Flemish ozone monitors with a deviation of less than 1%, the largest deviation from the UV reference calibration photometer was 6,8%. Simular results were obtained during the autumn control round.

1.1.3 Spatial interpolation scheme: RIO

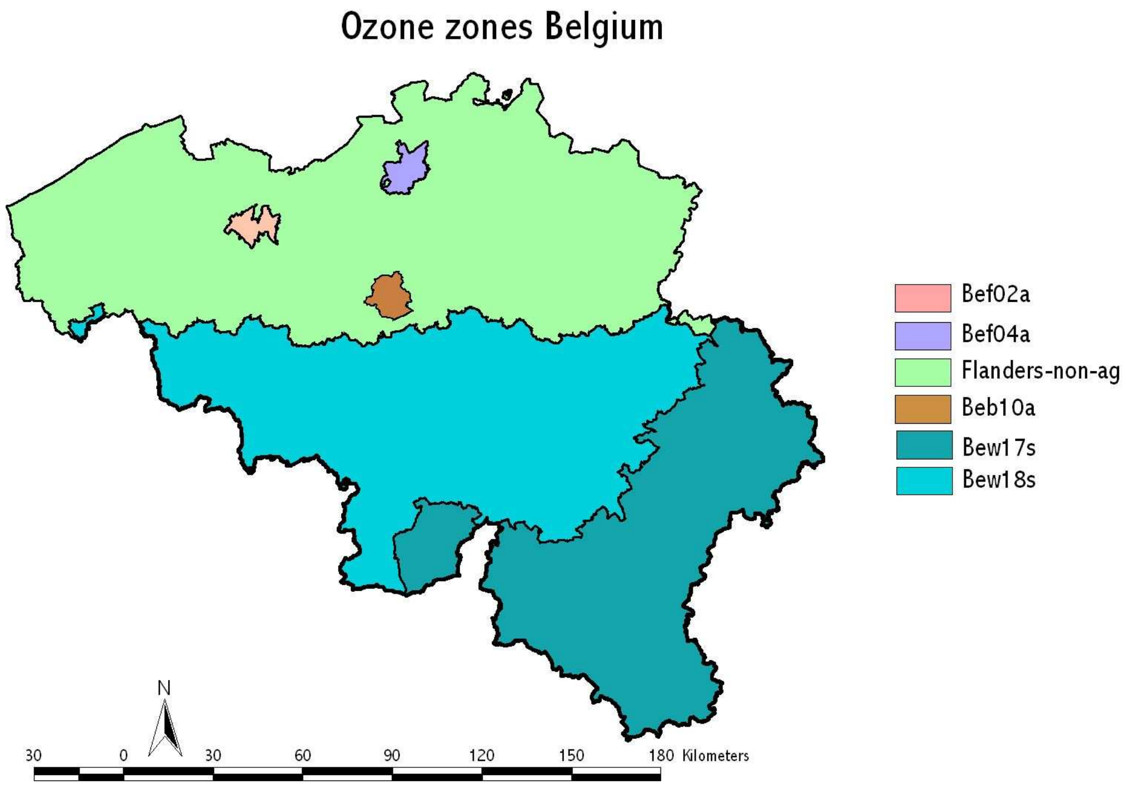
The RIO model (*Ruimtelijke Interpolatie voor Ozon*) represents a spatial interpolation technique specially designed for spatially assessing ozone concentrations in ambient air. It is based on measured concentration data in (sparse) measuring locations. The major feature of the RIO-scheme is that it accounts in each individual gridcel of the interpolation domain for the site-specific photochemical equilibrium between formation and destruction of ozone. This site-specific equilibrium state is, in a densely populated region with dense traffic, mostly governed by the destruction of ozone through titration by nitric oxide (NO).
A more detailed description is given in annex I.

1.1.3. Air quality zones

According to the provisions in the framework directive 96/62/EC for assessing air quality, the Belgian territory was split up by the Regions in zones and agglomerations in the way given in the following map.



For the specific purpose of assessing compliance with the target values for ozone, the Walloon territory is covered by 2 special ad-hoc zones: Bew17s (Ardenne) and Bew18s (Wallonie III). On the Flemish territory the two agglomeration zones were kept separately (Bef02a-Antwerpen and Bef04a-Gent) while the remaining surface was aggregated into one ad-hoc zone (Flanders_non_agglomeration) consisting of the zones Bef01a, Bef03a, Bef05a and Bef06a. This results finally in 6 zones for the specific purpose of assessing ozone:



Agglomerations and zones for the specific purpose of assessing ozone in Belgium:

in Flanders Region:
- agglomeration of Antwerpen : zone Bef02a
- agglomeration of Gent: zone Bef04a
- Flanders_non_agglomeration : sum of zones Bef01a, Belf03a, Belf05a, Belf06a

in Brussels-Capital Region
- agglomeration of Brussels: zone Beb10a

in Walloon Region:
- Ardenne : zone Bew17s
- Wallonie III: zone Bew18s

1.1.4. Population data

The official 2000 population data on the base of subcommunity census sectors from the NIS (National Institute for Statistics) were aggregated to the 5x5 km grid used in this report.

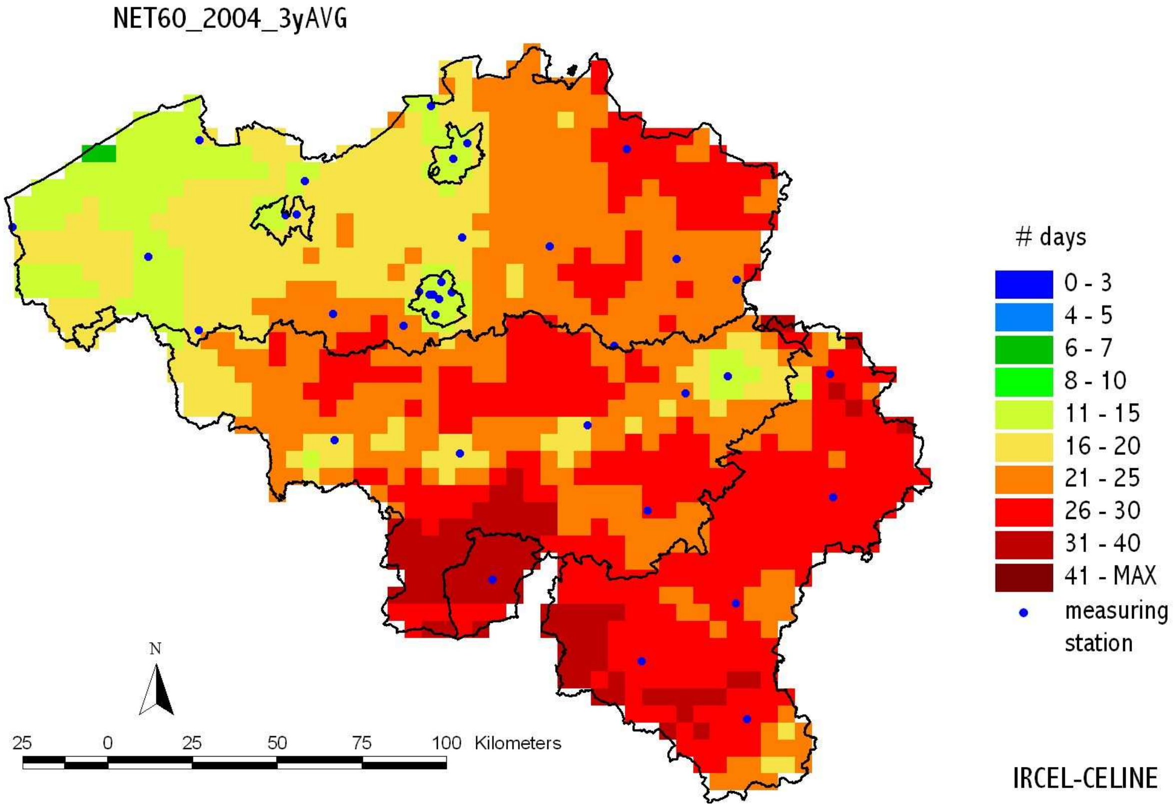
1.1.5. Mathematical treatment

Normal rounding: when calculating the 3-year or 5-year average value for the target values on the base of the individual annual data, a "normal rounding" procedure was performed on the result. The normal rounding can be expressed as: INT(result +0,5) which
- rounds down the result to the lower integer if the result decimal fraction is < 0,5
- and rounds up to the higher integer value if the result decimal fraction is ≥ 0,5.

1.2 Exceedances above the target value for the protection of human health

The target value allows for no more than 25 exceedance days per calendar year (averaged over 3 years) of the maximum daily 8-hour mean ozone concentration above 120 µg/m³.

Map of Belgium showing the number of days in a year with maximum daily 8-hour mean > 120 µg/m³ (three year average over the years 2002, 2003 and 2004). Contours of air quality zones are drawn.



Areas in red and deep red are above the 25 day limit specified by the target value (TV) for the protection of health. They are located in Ozone Air Quality zones belonging tothe Flanders and Walloon Regions. No exceedance days above the limit value of 25 were observed in the Brussels Region, nor in the agglomerations of Wallonia (Liège, Charleroi) and Flanders (Gent, Antwerpen).

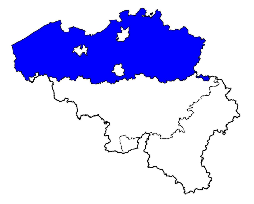
In 2004 (averaged over 3 years) 1 058 724 people in Belgium were exposed to levels above the target value, i.e some 10% of the total population. On a regional scale this means: 713 360 people in Wallonia (22% of the Walloon population) and 345 364 in Flanders (6 % of the Flemish population).

2002 - 2004 3 year average	People exposed above TV	% of people exposed above TV	Area exposed above TV (km²)	% of area exposed above TV
Flanders	345 364	5.8 %	1 650	12%
Wallonia	713 360	21.9%	10 075	60%
Brussels	0	0%	0	0%
BELGIUM	1 058 724	10.5%	11 725	38%

The higher exposure in the Southern part of Belgium (Wallonia) is mainly due to higher concentrations during non-episodic periods: higher background levels at night and averaged during the year. This can be attributed to less ozone titration by NO in the ambient air due to less traffic and industrial emissions in the Southern part, beneath the Samber-Meuse valley. Less titration means higher ozone background concentrations. Different topography (higher altitude) and vegetation cover (forest) of the Ardenne is another reason for higher ozone background concentrations.
The zones with exceedance days above the target value for the protection of human health (25 days) will be treated separately.

1.2.1 Zone "Flanders_non_agglomeration" (zones Bef01a + Belf03a + Belf05a + Belf06a)

Region	Flanders
Authority	
Type of zone	Non agglomeration
Population in zone	5 188 955
Area of zone (km²)	13 350



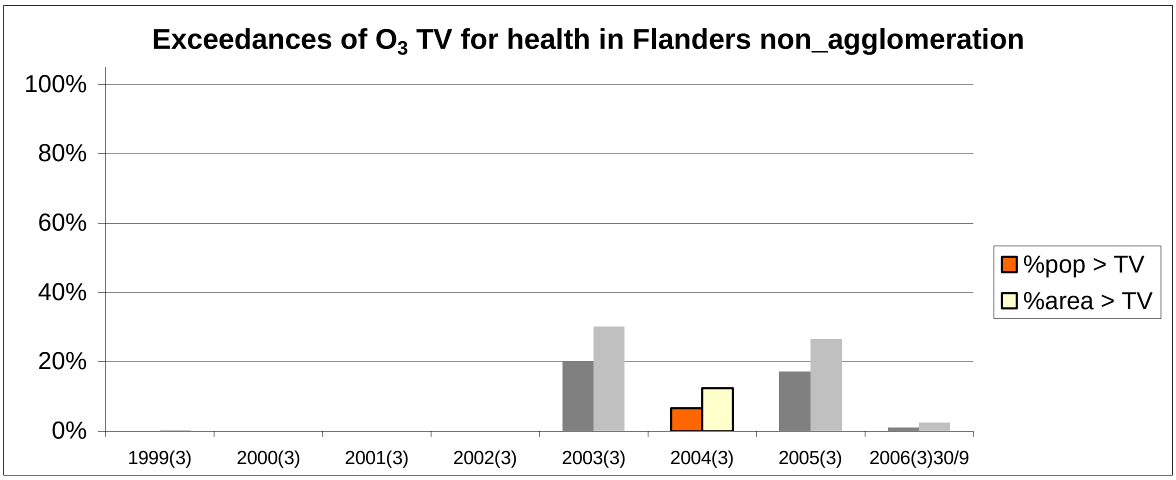
Population exposed above TV for health	345 364 (6,7 %)
Area exposed above TV for health	1 650 (12,4 %)

Number of exceedance days per calendar year averaged over 3 years (2002, 2003 and 2004)	# different exceedance days in zone	minimum in zone	mean in zone	mean in area above target value	maximum in zone
	38	7	19,1	26,8	33

Ozone measuring stations in zone (operated in 2004) as from Form 14a in the Questionnaire_2004

EoI station code	Location	# of exceedance days
42N016	Dessel	28
42N035	Aarschot	26
42N040	Sint-Pieters-Leeuw	24
42N045	Hasselt	22
42N046	Gellik (Lanaken)	24
42N054	Walshoutem (Landen)	23
42R811	Schoten	15
42R831	Berendrecht	14
42R841	Mechelen	12
44M705	Roeselare	14
44N012	Moerkerke (Damme)	12
44N029	Houtem (Veurne)	13
44N050	Sint-Denijs (Zwevegem)	22
44N051	Idegem (Geraardsbergen)	23
44R710	Destelbergen	15
44R740	Sint-Kruis-Winkel (Gent)	16

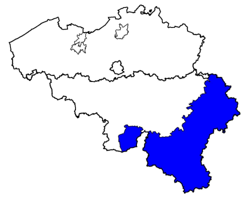
History and prognosis of exceedance days in the zone:



Explanation
The exceedance of the target value in 2004 in this zone of Flanders_non_agglomeration is due to the impact of the exceptionally high ozone concentrations in 2003, which are still featuring in the 3 year averaged value (2002, 2003 and 2004) for 2004. The 2003 ozone levels will remain present in the averaged value until 2005. The restricted area (only 12,4 %) above the target value is almost exclusively located in the rural Campine region where higher temperatures occur due to the sandy soil.

1.2.2 Zone Bew17s (Ardenne)

Region	Wallonia
Authority	
Type of zone	Non agglomeration
Population in zone	473 116
Area of zone (km²)	7 325



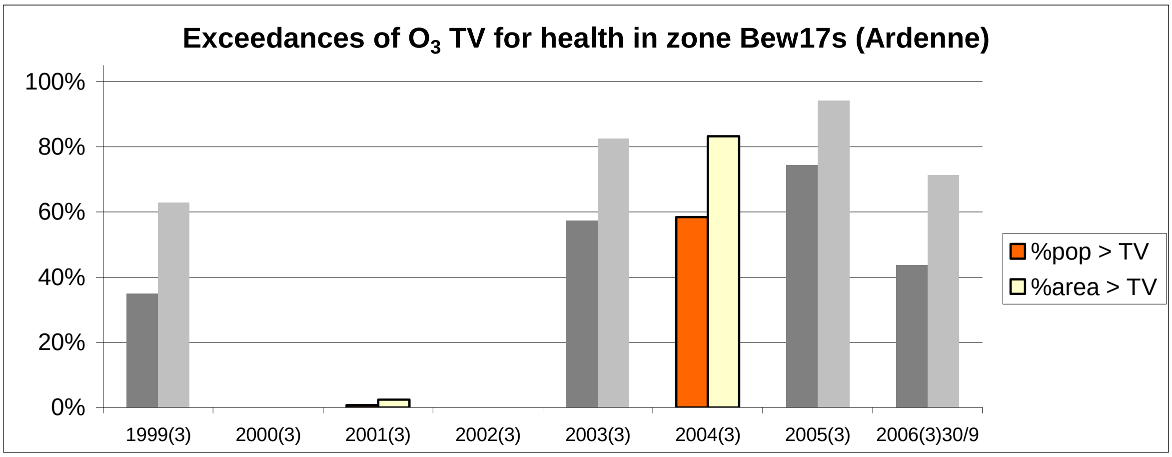
Population exposed above TV for health	276 547 (59 %)
Area exposed above TV for health	6 100 (83 %)

Number of exceedance days per calendar year averaged over 3 years (2002, 2003 and 2004)	# different exceedance days in zone	minimum in zone	mean in zone	mean in area above target value	maximum in zone
	43	14	25,0	28,3	34

Ozone measuring stations in zone (operated in 2004) as from Form 14a in the Questionnaire_2004

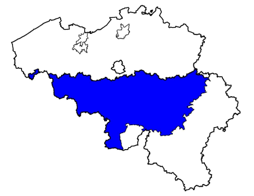
EoI station code	location	# of exceedance days
43N066	Eupen	31
43N085	Vielsalm	27
43N100	Dourbes (Viroinval)	34
43N113	Sainte-Ode	26
43N121	Offagne (Paliseul)	29
43N132	Habay-la-Neuve (Habay)	30

History and prognosis of exceedance days in the zone:



Explanation
The Ardenne zone is the most affected zone in Belgium as far as exceedance days above the target value for health protection is concerned. Besides topography (higher altitudes up to 400 m) the less titration by nitric oxide (NO) is the main reason for the higher levels of the ozone background concentrations during non-episodic periods. Already in 1999 this zone was exposed to relatively high exceedance levels. But as in the other zones, the levels of 2003 make the high exceedance percentages to last for up to 2005. But anyway, this zone will still experience high exposure in the coming years (see preliminary data for 2006).
All measuring stations in this zone recorded exceedances above the target value for the protection of health (more than 25 days).

1.2.3 Zone Bew18s (Wallonie III)

Region	Wallonia	
Authority		
Type of zone	Non agglomeration	
Population in zone	2 777 233	
Area of zone (km²)	9 575	

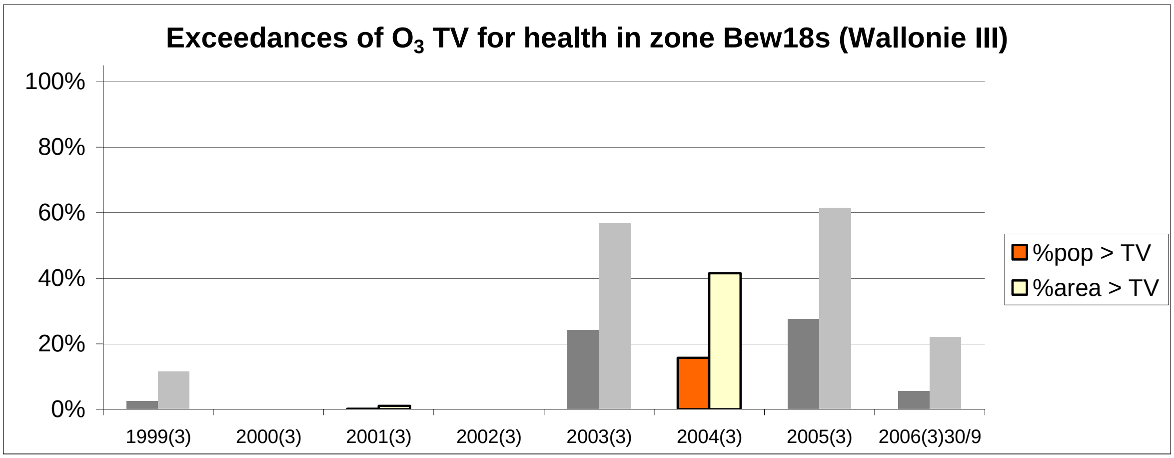
Population exposed above TV for health	436 813 (16 %)
Area exposed above TV for health	3 975 (42 %)

Number of exceedance days per calendar year averaged over 3 years (2002, 2003 and 2004)	# different exceedance days in zone	minimum in zone	mean in zone	mean in area above target value	maximum in zone
	40	11	20,5	27,6	34

Ozone measuring stations in zone (operated in 2004) as from Form 14a in the Questionnaire_2004

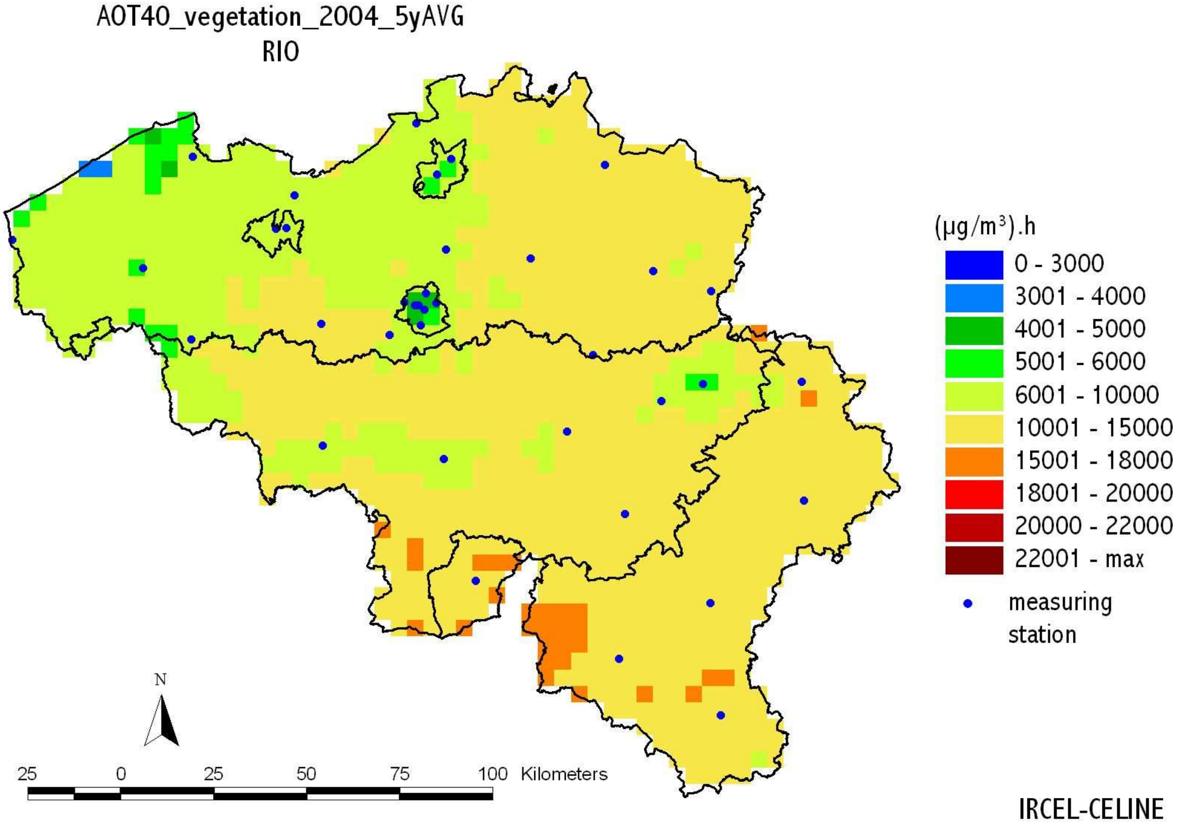
EoI station code	location	# of exceedance days
43N070	Mons	13
43N073	Vezin (Andenne)	21
43N093	Sinsin (Somme-Leuze)	22
43R201	Liège	18
43R240	Engis	21
45R502	Lodelinsart (Charleroi)	20

History and prognosis of exceedance days in the zone:



Explanation
Although no individual measuring station shows exceedances above the target value for health protection (all are below 25 exceedance days), the spatial interpolation technique, which accounts for the NO-titration capacity also in spots where no measuring stations are located, turns up with a non-negligible area (42 %) and population (16 %) exposed to exceedances above the target value. According to the interpolated data, there are 40 different days with exceedances of the 120 µg/m³ threshold. Even without using any interpolation technique and only on the base of the measurements at the 6 ozone stations in this zone, there are 31 different days (averaged over 2002-2004) on which the threshold of 120 µg/m³ was exceeded. This means that the zone is in exceedance of the EU target value which allows only 25 days of exceedance.
As was seen for the other zones, the exceedance days start in 2003 with the high ozone levels recorded that year. 2003 wil influence the 3 years average value until 2005. Afterwards, a decreasing exposure may be expected in this zone.

1.3 Exceedances of the target value for the protection of vegetation



There are <u>no exceedances of the target value for the protection of vegetation</u>: the 5 year average (2000 till 2004) of the AOT40_vegetation values (from May till July measured between 8:00 and 20:00 CET hours) do not exceed 18 000 (µg/m³).h.

In fact the highest value is 16 398 (µg/m³).h with a spatial mean value over Belgium of 11 138 (µg/m³).h. When restricted only to arable land and land with semi-natural vegetation the mean value for AOT40_vegetation is 10 042 (µg/m³).h.

2.1 Modelling

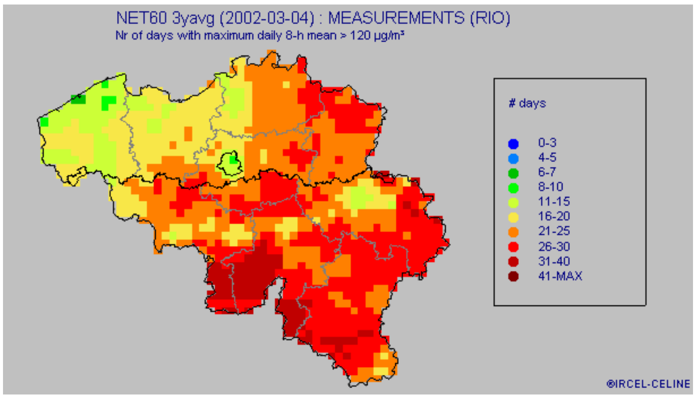
2.1.1 Model simulation of the actual situation (NET60ppb in 2002-2003-2004)

The Europe-wide belEUROS model (Delobbe L. et al, 2001 and Deutsch F. et al, 2004) was adapted to simulate the $NET60_{ppb}$ metric (number of days with adaily maximum 8-h mean higher than 120 µg/m³)[1]. As can be expected from large and complicated models, they are more accurate when simulating average concentration values, like annual mean values, than when simulating event probabilities of exceeding yes-or-no of a *threshold*, which is the way the Target Values for health is expressed in the Directive 2002/3/EC. This is because the calculation of the number of exceedances is very much influenced by relative small differences in modelled concentrations. Nevertheless, the belEUROS model was able to simulate the $NET60_{ppb}$ metric in a usefull way so that it can forecast within a given range, the estimation of future attainment of the ozone target values for health.

First the model has to be calibrated against the measurements of the 3-year averaged number of days of exceedance by the daily maximum 8-hour of the 120 µg/m³ threshold ($NET60_{ppb}$). This is done by calculating the RMS-error between measured and modelled values for each gridcell within Belgium.

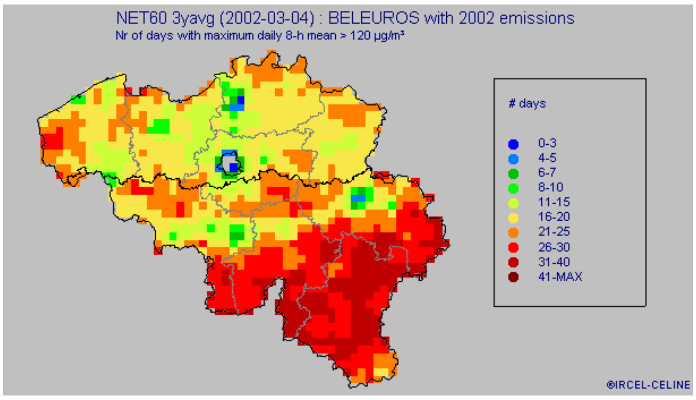
Measurements: 3-year average over 2002/03/04

NET 60_{ppb} TV 25	MEASUREMENTS (RIO) 3 year average 2002-2003-2004 pop > TV	%pop > TV	area > TV	%area > TV
1 Antwerpen	79,358	5%	350	12%
3 West-Vlaanderen	0	0%	0	0%
4 Oost-Vlaanderen	0	0%	0	0%
5 Hainaut	151,831	12%	1,250	33%
6 Liège	139,104	14%	2,000	51%
7 Limburg	210,361	27%	975	40%
8 Luxembourg	134,060	58%	3,500	79%
9 Namur	185,952	42%	2,675	72%
10 Vlaams-Brabant	55,645	5%	325	15%
11 Brabant Wallon	102,413	29%	650	62%
12 Brussel	0	0%	0	0%
1 Brussel	0	0%	0	0%
2 Vlaanderen	345,364	6%	1,650	12%
3 Wallonie	713,360	22%	10,075	60%
4 Duitstalig	37,914	**79%**	800	94%
BELGIE	1,058,724	11%	11,725	38%



Model for 3-year average over 2002/03/04

NET 60_{ppb} TV 25	BELEUROS_14L april - sept 2002/03/04 with 2002 emissies pop > TV	%pop > TV	area > TV	%area > TV
1 Antwerpen	0	0%	0	0%
3 West-Vlaanderen	11,820	1%	225	7%
4 Oost-Vlaanderen	1,532	0%	25	1%
5 Hainaut	48,075	4%	750	20%
6 Liège	93,624	9%	1,725	44%
7 Limburg	3,196	0%	50	2%
8 Luxembourg	166,727	72%	4,050	91%
9 Namur	142,432	32%	2,475	67%
10 Vlaams-Brabant	0	0%	0	0%
11 Brabant Wallon	11,837	3%	100	10%
12 Brussel	0	0%	0	0%
1 Brussel	0	0%	0	0%
2 Vlaanderen	16,548	0%	300	2%
3 Wallonie	462,695	14%	9,100	54%
4 Duitstalig	29,235	61%	700	82%
BELGIE	479,243	5%	9,400	31%



[1] Delobbe L., Mensink C., Schayes G., Brasseur O., Passelecq C., Passelecq D., Dumont G. & Demuth C. (2001) BelEUROS: Implementation and extension of the EUROS model for policy support in Belgium, Study for the Prime Minister's Services, Federal Office for Scientific, Technical and Cultural Affairs, OSTC Contract Report AS/00/10, March 2001.

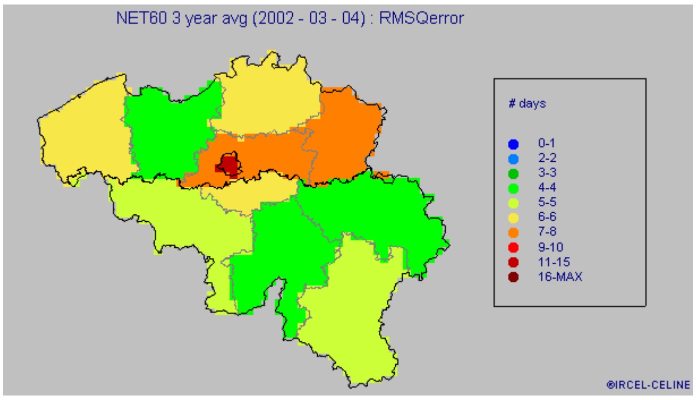
Deutsch F., Lefebre F., Vankerkom J., Adriaensen S. & Mensink C. (2004) Modellering van fijn stof.; Studie uitgevoerd in opdracht van de Vlaamse Milieumaatschappij, VITO Eindrapport 2004/IMS/R/205 juli 2004

Model simulation indicates about only half of the people exposed above the Targte Value for health in comparison with reality.The southern part (Wallonia) is rather well modelled. In Flanders there seems to be an underestimation of NET60ppb days in the eastern half (provinces of Limburg, Brabant and Antwerpen). In the following map a surbey of the RMS-error (the root of the mean of the squares of the differences between model and measurement) for each gridcel is presented.

RMS-error for 3-year average over 2002/03/04

Root of Mean of Squares of differences between measurements (RIO) and model (belEUROS)

			NET60ppb	in %
1	Antwerpen		5.1	24%
3	West-Vlaanderen		5.9	40%
4	Oost-Vlaanderen		3.9	21%
5	Hainaut		4.6	19%
6	Liège		3.0	12%
7	Limburg		6.2	25%
8	Luxembourg		4.3	16%
9	Namur		3.3	12%
10	Vlaams-Brabant		6.0	27%
11	Brabant Wallon		5.3	21%
12	Brussel		11.3	94%
1	Brussels		11.3	94%
2	Flanders		5.4	27%
3	Wallonia		4.0	15%
4	German-speaking		3.0	11%
	BELGIUM	average	4.7	21%
		90 P	7.0	36%



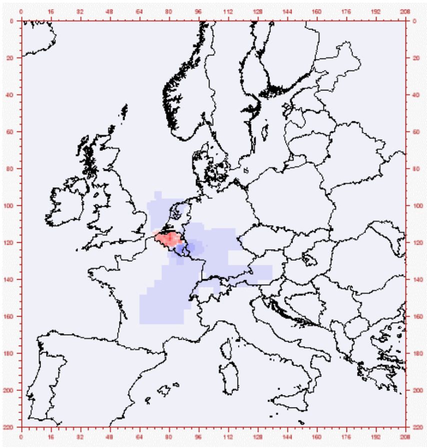
The belEUROS model results differ on an average by 4,7 exceedance days compared to the measurements. This represents an averaged RMS-error of 21%. The 90-percentile of the relative RMS differences in all gridcells is 36% which is acceptable compared with the 50% modelling uncertainty as proposed in Annex I, A. of the Common Position on a new "Directive on ambient air quality and cleaner air for Europe".

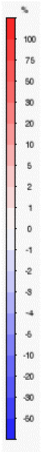
Relative model accuracy is best in Wallonia (15%) and worst for the simulation of urban $NET60_{ppb}$: 94% in Brussels, probably also due to overestimation of the NOx-emissions in the Brussels-Capital region. These RMS-values, differentiated by province, will be used for "uptuning" the forecast model output of $NET60_{ppb}$ for the future scenarios.

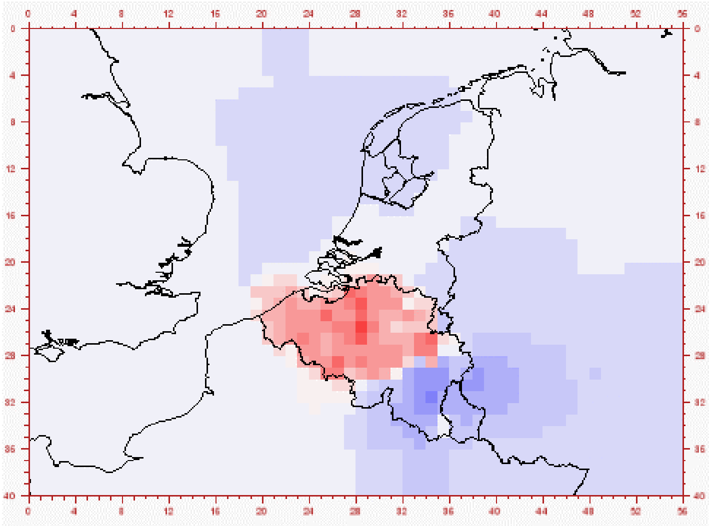
2.1.2 Transboundary nature of ground-level ozone pollution (import/export from/to other regions)

The normal procedure for estimating the transboundary import of a pollutant from other countries into Belgium, is to calculate the result on Belgian concentrations when all own Belgian emissions are set to zero. But ozone would not be ozone if it was as simple as that. Because ozone levels in Belgium are the result of an chemical equilibrium between photochemical formation on one hand and the depletion of ozone by freshly emitted NO on the other hand, setting to zero all own emission, inclusive the ozone depleting NO-emissions, will on most places result in an increase of the ozone levels. This is proven by the modelresult in the maps below.

*Effect on ozone daily maximum 8-hour average when **all BELGIAN emissions are set = 0** (summermean over April - September 2004, meteorology of 2004, emissions of 2002)*







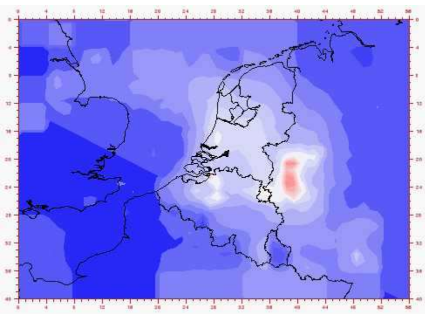
BelEUROS: full model domain

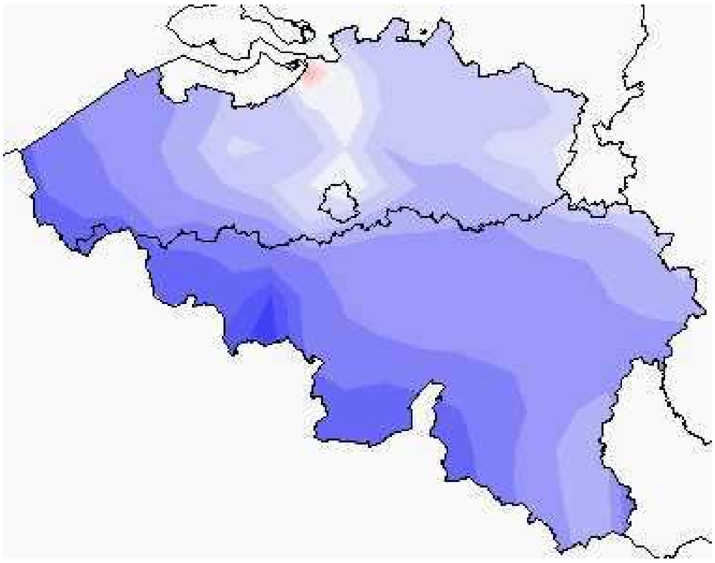
BelEUROS: zoom on hotspot regio

Blue color indicates the % improvement of ozone daily maximum 8-hour average during April-September 2004 if all Belgian emissions are set to 0. Red color indicates a % increase.

The appropriate way to determine the cross-border impact on ozone formation in Belgium would be to make the import/export balance of ozone precursors (NOx and NMVOC). And even this would not be correct because of the non-linear response of ozone formation to changes in emissions and import of precursors.
This is another prove that ozone abatement strategies only can be succesfull if carried out at a European scale. Such a large scale strategy will effectively reduce ozone peaks as is demonstrated in the following simulation where for all EU-countries involved in the belEUROS model domain, the attainment of the NEC-emission reductions will cause a significant reduction of the $AOT60_{ppb}$ burden in Belgium.

Effects on ozone AOT60ppb when all EU-countries achieved full implementation of the NEC emission reductions foreseen for 2010
(year 2002, meteorology of 2002, NEC-emissions)





BelEUROS : hotspot region

BelEUROS : zoom on Belgium

Blue color indicates the % improvement of ozone $AOT60_{ppb}$ for the year 2002 if all countries did already achieve the emission reductions required by the NEC Directive 2001/81/EC for 2010. Red color indicates a % increase.

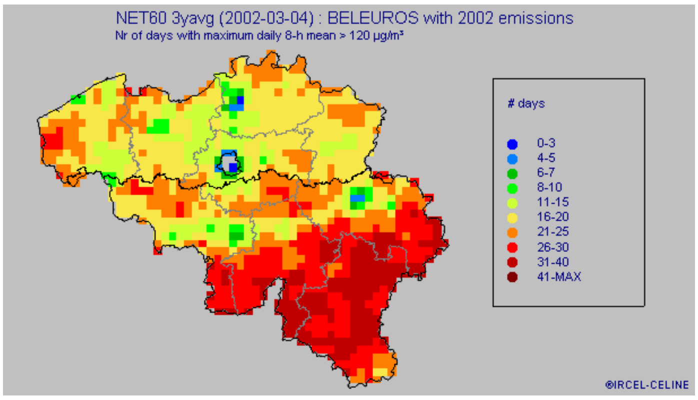
According to these modelresults the spatial average over Belgium of the AOT60ppb value in 2002 would improve by some 40% if all EU-countries would have realised the NEC emission reductions required by the EU-Directive 2001/81/EC.

2.1.3 Model forecast of NET60$_{ppb}$ in 2015

Using the CLE emissions for 2015 (Current Legislation Emissions from the baseline scenario as used and described by IIASA in CAFE Scenario Analysis Report Nr 1, February 2005) and the meteorology from ECMWF for the years 2002, 2003 and 2004, future NET60$_{ppb}$ values were calculated by belEUROS. In order to take account or the model bias as seen by the RMS-study, the result for each gridcell was <u>added</u> with the province specific number of "rms"-days. The outcome is represented in the lower map.

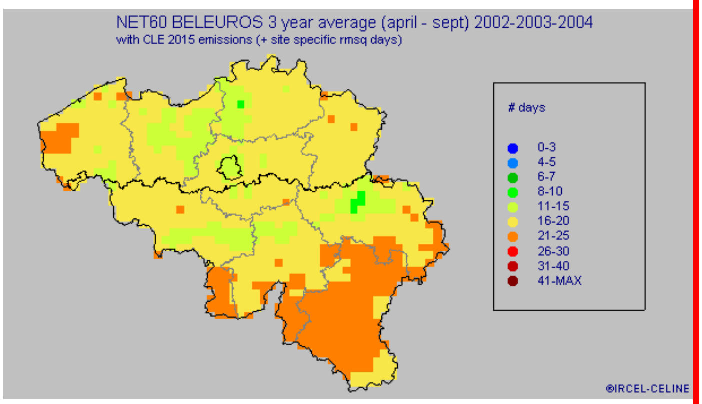
Model for 3-year average over 2002/03/04

NET 60$_{ppb}$ TV 25	BELEUROS_14L april - sept 2002/03/04 with 2002 emissies pop > TV	%pop > TV	area > TV	%area > TV
1 Antwerpen	0	0%	0	0%
3 West-Vlaanderen	11,820	1%	225	7%
4 Oost-Vlaanderen	1,532	0%	25	1%
5 Hainaut	48,075	4%	750	20%
6 Liège	93,624	9%	1,725	44%
7 Limburg	3,196	0%	50	2%
8 Luxembourg	166,727	72%	4,050	91%
9 Namur	142,432	32%	2,475	67%
10 Vlaams-Brabant	0	0%	0	0%
11 Brabant Wallon	11,837	3%	100	10%
12 Brussel	0	0%	0	0%
1 Brussel	0	0%	0	0%
2 Vlaanderen	16,548	0%	300	2%
3 Wallonie	462,695	14%	9,100	54%
4 Duitstalig	29,235	61%	700	82%
BELGIE	479,243	5%	9,400	31%



Model CLE- 2015 emissions + site specific rms days

NET 60$_{ppb}$ TV 25	BELEUROS 3 y avg (april - sept) 2002-03-04 (+site specific rmsq days) with CLE 2015 emissions pop > TV	%pop > TV	area > TV	%area > TV
1 Antwerpen	0	0%	0	0%
3 West-Vlaanderen	0	0%	0	0%
4 Oost-Vlaanderen	0	0%	0	0%
5 Hainaut	0	0%	0	0%
6 Liège	0	0%	0	0%
7 Limburg	0	0%	0	0%
8 Luxembourg	0	0%	0	0%
9 Namur	0	0%	0	0%
10 Vlaams-Brabant	0	0%	0	0%
11 Brabant Wallon	0	0%	0	0%
12 Brussel	0	0%	0	0%
1 Brussel	0	0%	0	0%
2 Vlaanderen	0	0%	0	0%
3 Wallonie	0	0%	0	0%
4 Duitstalig	0	0%	0	0%
BELGIE	0	0%	0	0%



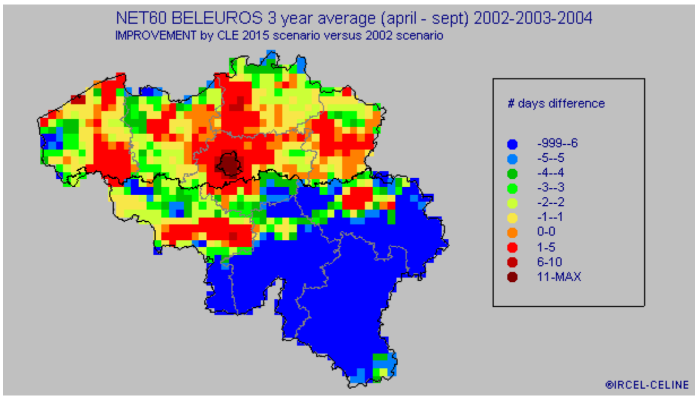
Under the assumption of achievement of the CLE measures in all European countries by 2015, there will be no more exceedance of the ozone Taget Value for health protection in Belgium. The changes in number of exceedance days between the 3 year period 2002-2003-2004 and 2015 is represented in the map below.

NET60ppb 3 year average 2002/03/04

% difference between
belEUROS 2015 - belEUROS 2004

increase of NET60 days

decrease of NET60 days

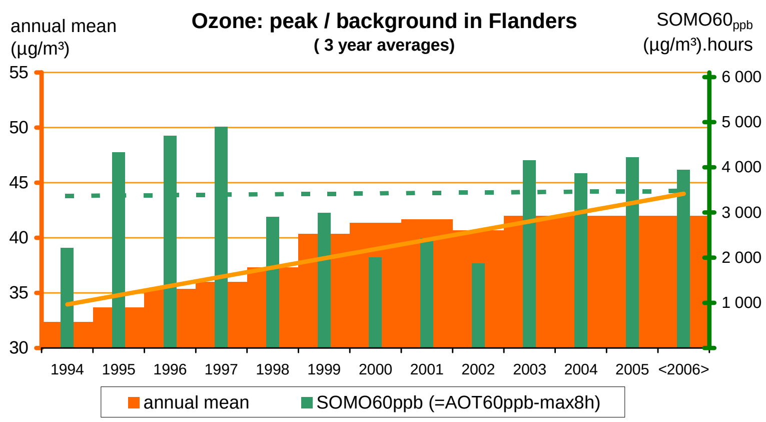


Note that there will be an **increase** in number of exceedance days in the agglomerations, cities and in Flanders (red coloured areas) but this will no longer happen on more than 25 days per year allowed by the target value. In the rural areas of Wallonia (beneath the Samber-Meuse valley) in the south there will be effectively a **decrease** in the number of days on which the daily maximum 8-h mean concentration will rise above the 120 µg/m³ threshold.

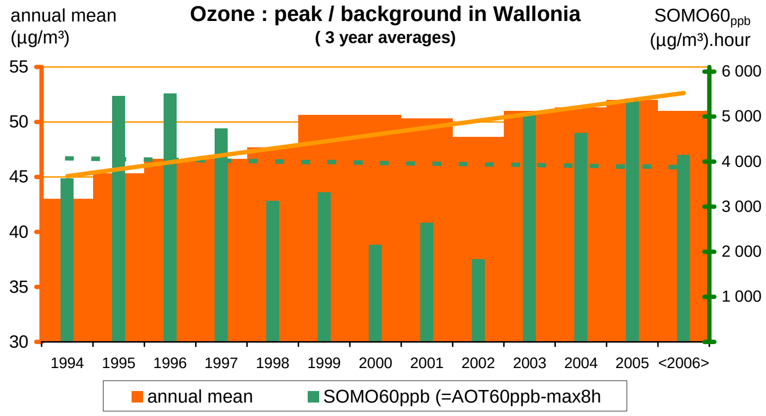
2.2 Peaks tend to decrease - background to increase

In the global update of WHO Air Quality Guideline for PM, ozone, NOx and SO2 (2006) an Air Quality Guideline for ozone of 100 µg/m³ for the daily maximum 8-hour mean is proposed. This was due to significant additions to the health effects evidence from recent epidemiological time-series studies. Although there is some evidence that long-term exposure to ozone may have chronic effects, it was not considered sufficient by the WHO to recommend an annual guideline. Based on those new evidences theWHO working group meeting in Bonn (January 2004) already concluded that it is not possible for all health outcomes to confidently define an unequivocal non-effect threshold for the whole population. These conclusions should warn us to assess ozone effects on health not only on the base of the current target values which are threshold based, but also in terms of long-term background concentrations such as the (rising) annual mean values.

Peak/background trends show a stabilising or even slightly decreasing peak burden (SOMO60ppb) while background concentrations (annual mean values) show a worrying steady increase.



Ozone 3-yearly background concentration (annual mean values) in **Flanders** is increasing with 0,8 µg/m³ per year since 1994 and comes close to 43 µg/m³ nowadays
3-year averages of $SOMO60_{ppb}$ values (integrated peak burden above 120 µg/m³) is stabilising or slightly decreasing



Ozone 3-yearly background concentrations (annual mean values) in **Wallonia** are some 10 µg/m³ higher than in Flanders, due to lower NO_x levels in the more rural areas in Wallonia. Although the background concentration is also increasing since 1994, there seems to be a more stabilising plateau around 50 µg/m³ since 1999.
3-year averages of $SOMO60_{ppb}$ values (integrated peak burden above 120 µg/m³) are slightly decreasing

The increasing background is also observed in other neighbouring countries (with the same VOC-controlled ozone regime) and is commonly attributed to two factors:

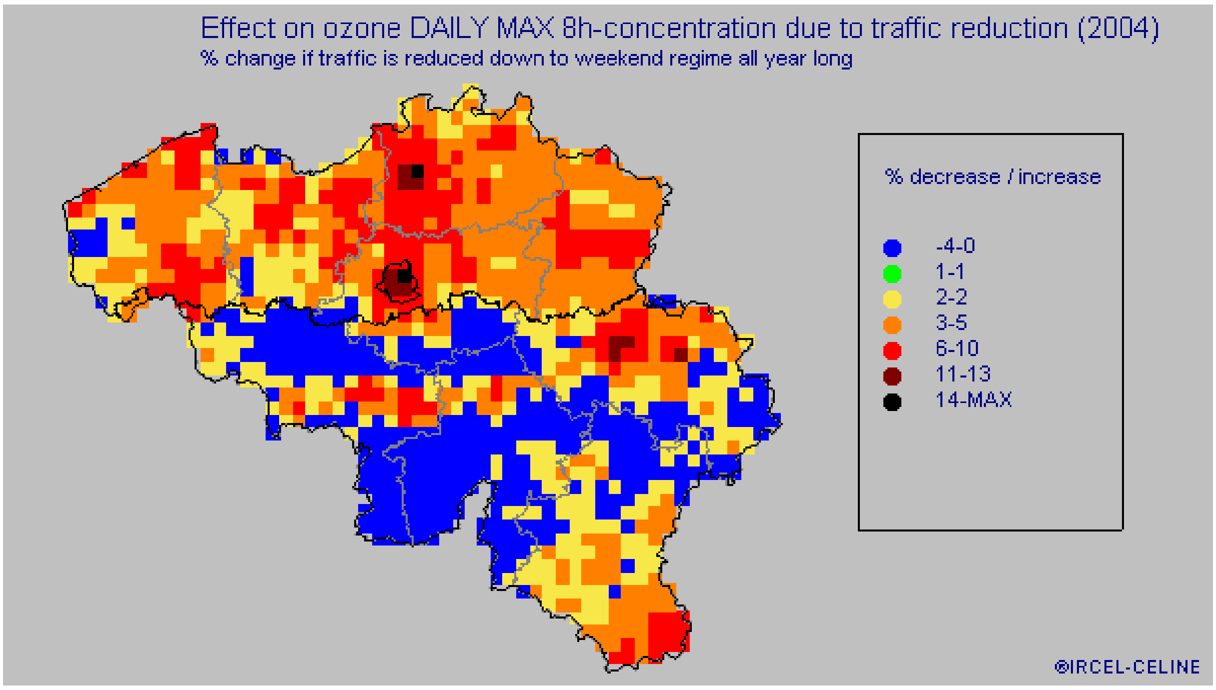
- a general increase in ozone precursor emissions (NOx and VOC (and also CH_4 and CO) in the northern hemisphere caused by increased emissions in North America as well as in Asia. The hemispheric emissions increase in spite of the decreasing emissions in Western Europe. This phenomenon is well illustrated by the Mace Head Observatory (Ireland) ozone time series demonstrating an increase in background concentration of 0,49 ± 0,13 ppb per year during the past 16 years;
- since the beginning of the 90's, end-of-pipe measures in traffic (like the 3-way catalyser) were generally introduced in Western Europe. They reduced effectively the VOC emissions by cars which indeed led to lower ozone peaks in VOC-controlled areas. But the accompanying reduction of NOx emissions unfortunately increased the ozone background levels in the first place due to the diminished NO titration (see the weekend effect)

Chapter 3: Plans and programmes in order to attain the target values, save where not achievable through proportionate measures, as from 2010

3.1 Measures on a Belgian scale

3.1.1 *Effect of medium term traffic reduction down to weekend regime all year long in 2004*

As this report deals with the exceedances of the TV for health which value is linked to the daily maximum 8-hour concentration, this metric was studied separately on working days and on non-working days (weekend days and holidays). The ratio of the daily max8h-concentrations on non-working days divided by the max 8h-concentrations on all days in 2004, gives the relative improvement that could have been expected if non-working conditions were present all days of the year. Non-working conditions mean a decrease of some 30% of traffic density, as could be derived from the decrease of traffic related pollution like NO.
It is not surprising to see that in cities and areas with dense traffic and population in Belgium, the ozone concentrations on non-working days are higher than on working days. This so-called weekend effect is to be attributed to the decrease of ozone titration by NO close to the NO emitting sources (cities). A decreases titration means an increased ozone concentration. This is due to the fact that in Belgian cities the ozone situation is governed by the VOC concentrations in the ambient air

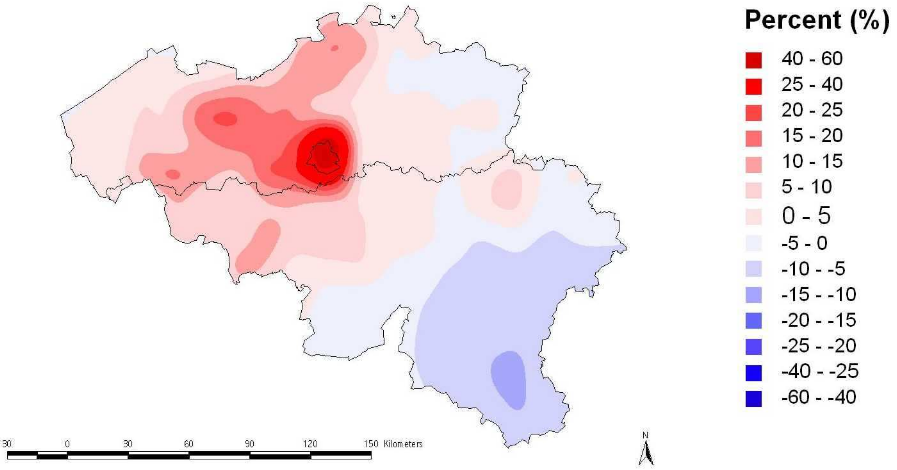


The overall *increase* in ozone daily max 8h-concentration in Belgium is 2,5 % if traffic on all days of the year would have been *reduced* to the weekend regime which is a reduction with some 30 % of the traffic density. In Wallonia the increase would be 1,2%, in Flanders 4% and in Brussels even 11 %. The real benefit of such a traffic reduction where the change would be a net decrease of the daily max 8h-concentration is limited to a 2 925 km² area mostly in Wallonia concerning some 219 500 people that is 2,2 % of the total population of Belgium. The reason why the decrease in traffic density causes an increase in ozone is because of the diminishing ozone titration in cities by NO in the VOC-controlled ozone regime that governs most of the industrial regions in West-Central Europe. In the most rural areas of Belgium (see e.g. Ardenne in Wallonia) where there is much less traffic and much lower population density, the increase is less than in the cities and the northern part with much denser traffic and population.

3.1.2 Effect of ad-hoc temporary reduction of traffic to weekend regime on 3 weeks before and during an ozone smogepisode.

Limited local traffic measures may end up in an increase of ozone peak concentrations. This is demonstrated in the figure below. The ozone situation during the heat/ozone episode in August 2003 has been simulated by the BelEUROS-model, once with real emissions from traffic in Belgium and once with the Belgian traffic emissions reduced to weekend-level during 3 weeks starting one week before the real episode. During the weekend regime the NOx emissions from traffic are lowered by some 30% and the VOC-emissions by 20%. The figure shows the difference between the results of the two modelruns.

Relative difference between modelled AOT60$_{ppb}$ values, once with and once without traffic reduction to weekend regime for 3 weeks in Belgium during an ozone episode (Belgum, 1 - 14 August 2003)



Red coloured areas show an increase in ozon peaks after the traffic was reduced to weekend regime. The blue colour indicates areas where the ozone peaks are lower if traffic measures would have been taken.

Source: IRCEL-CELINE, belEUROS simulation 2005

In almost the whole area north of the Samber -Meuse valley, where ± 90 % of the Belgian population is living, the **ozone peaks** (AOT60$_{ppb}$) **would have been higher** if the weekend traffic regime was applied during 3 weeks (one week before and 2 weeks) during the smogepisode. In Brussels the increase in ozone peaks would have been more than 40%. Only in truly rural areas in southern Belgium (Ardenne) ozone peaks would effectively been lower.

3.2 Plans and programmes for the zone "Flanders_non_agglomeration"

3.2.1 Responsible authorities

Belgium is a Federated state, where most of the environmental competences are assigned to the regional governments. The federal government is responsible for the elaboration of product standards. Measures to reduce exceedances of ozone target values are the same measures as those that are described in the NEC-emission reduction programme. This programme contains contributions from the three regions and from the federal government. In this chapter, measures that reduce the Flemish emissions are described.
Organisation responsible for the development and implementation of improvement plans in Flanders is

Vlaamse Overheid - Departement Leefmilieu, Natuur en Energie
Afdeling Lucht, Hinder, Risicobeheer, Milieu & Gezondheid

Graaf de Ferraris-gebouw
Koning Albert II-laan 20, 2e verdieping
B-1000 BRUSSEL

Contact person : Mr. Bob Nieuwejaers (bob.nieuwejaers@lne.vlaanderen .be)

3.2.2 Origin of pollution

Emissions of ozone precursors NOx and VOC from the major emission sources are given in the next tables.

Table : NO_x emissions in Flanders (kton)

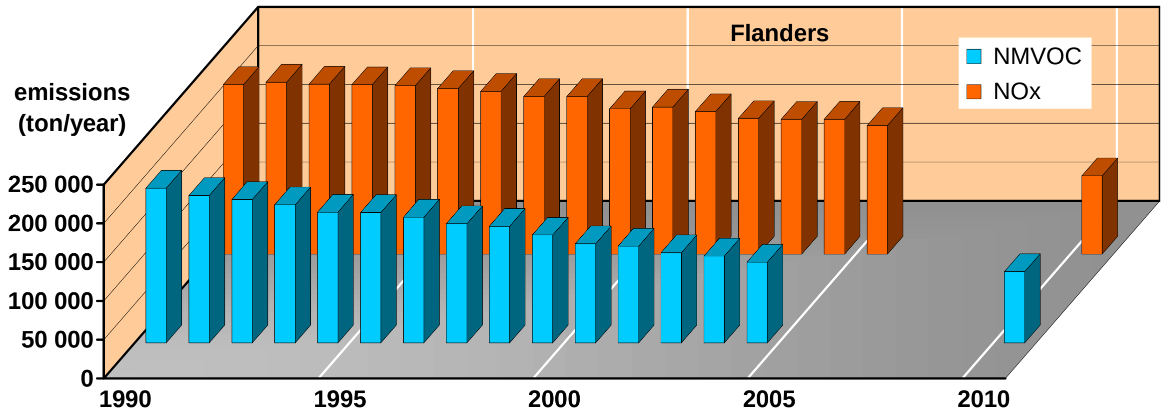
sector	1990	1995	2000	2001	2002	2003	2004
electricity producers	46,8	40.1	29,1	24,5	19,5	22,1	22,5
oil refineries	9,1	6.9	7,5	7,8	7,4	8,0	8,0
industry	30,8	39.6	33,1	33,9	34,1	30,4	33,0
residential sources	11,1	13.1	13,0	14,0	13,4	14,5	14,2
transport	121,1	113.7	106,9	103,6	100,6	98,8	96,3
total	**218,9**	**213.5**	**189,5**	**183,8**	**174,9**	**173,8**	**174,0**

Table : Anthropogene VOC emissions in Flanders (kton)

sector	1990	1995	2000	2001	2002	2003	2004
residential heating	5,9	5.7	5,3	5,6	4,8	5,3	5,2
combustion emission	5,9	5.9	6,9	7,6	7,7	7,8	7,9
process emissions	111,1	93.9	72,7	71,2	67,4	63,5	57,6
domestic use of products	12,0	12.2	12,4	12,6	12,6	12,4	12,4
transport	64,7	50.4	30,4	27,6	23,9	23,0	21,0
total	**199,7**	**168.1**	**127,7**	**124,8**	**116,3**	**111,9**	**104,1**

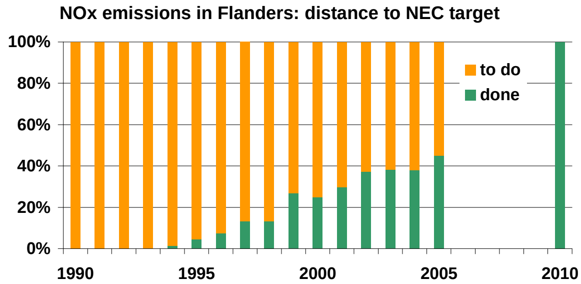
Source: Lozingen in de Lucht 1990 - 2004, Anoniem (2004) Vlaamse Milieumaatschappij, Aalst, Belgium

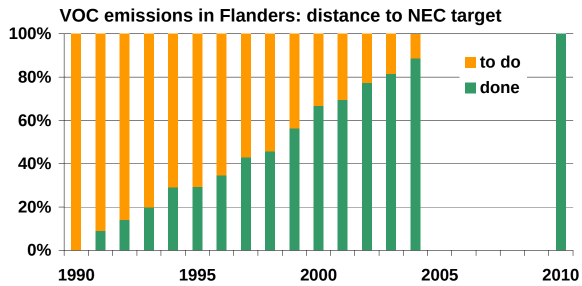
Progress towards NEC-objectives in 2010 for the NOx and NMVOC emission reductions in Flanders (1990 - 2010)



Source: Lozingen in de Lucht 1990-2004, (2004), Vlaamse Milieumaatschappij, Aalst

Distance to NEC targets can be summarized as follows





As in many sourrounding countries , the attainment of the NOx-reduction will be much more problematic than the timely attainment of the NMVOC-reduction. The total European emission of NOx in 2004 fell to 30% less than the 1990 levels, the UNECE recently reported (15 December 2006). Total VOC emissions has fallen by 38%. VOC reduction has always a positive ozone reduction potential, while NOx reductions, as amply demonstrated in this report, do not necessarely result in a reduction of ozone levels in VOC-controlled regions.

Stationary sources

3.2.3 Measures before 2002

The most important measure for the reduction of (industrial) emissions was the introduction of the Vlarem-legislation in 1993, incorporation all environmental legislation that existed then. Vlarem is changed regularly to keep track of the technological evolution.
On the national level, there was a covenant with the electricity producers that ran between 1991 and 2003 and that included agreements on the reduction of emissions of SO_2 and NO_x for this sector.

3.2.4 Measures since 2002

Since 2002 additional measures have been taken to reduce emissions of NO_x and/or VOCs:

- strengthening of emission limit values (in Vlarem) for all kind of stationary combustion installations, beyond the obligations of the LCP-directive (NO_x);
- strengthening of bubble emission limit values for refineries (NO_x);
- strengthening of emission limit values for waste combustion (NO_x);
- Environmental policy agreement with the electricity producers, including fixed ceilings for SO_2 and NO_x for this sector up to 2009 (with an option of prolongation until 2014) (NO_x);
- Publication of a royal decree on the NO_x emission levels of domestic gas or oil fuelled installations (NO_x – this is a federal competence);
- Implementation of the solvent directive (1999/13/EG) (VOC);

- Implementation of product regulation for decorative paints and vehicle refinishing products in Federal legislation (directive 2004/42/EG) (VOC);
- Implementation of BAT in dry cleaning and vehicle refinishing (VOC):
- Implementation of stage II vapour recovery in petrol stations (VOC);

For more detailed information on these measures, we refer to the NEC programma that will be reported to the Commission by the end of 2006.

Non-stationary sources

3.2.5. Measures before and since 2002

On 17 October 2003, the Flemish government gave its approval in principle to the policy intentions under the Flanders Mobility Plan, which contains recommendations to the Flemish government on mobility policy. The following concrete actions have been taken:

- conceiving and supporting ICT projects for accessible, demand-led, simplified and integrated public services;
- promoting teleworking and home working within Flemish government departments
- supporting carpooling
- measures to promote the use of public transport:
  - high-quality mobility agreements: between the local authorities, the Flemish Region and the De Lijn public transport corporation on the supply of public transport services, dedicated tram and bus lanes, provision of information, etc.
  - upgrading of public transport
  - financial attractive, simple season ticket formulas:
  - measures to promote inland waterway navigation:
    - subsidies for loading and unloading quays;
    - automation of locks, widening of canals;
    - reduction of navigation charges;
    - electronic payments;
  - company transport plans
  - expanding cycling infrastructure and enhancing safety.

Furthermore measures are taken to stimulate the use of eco-friendly vehicles and fuels:

- The Flemish government is implementing a number of instruments to expand the **government's fleets** in an eco-friendly manner:
  - Cooperation agreement with municipal authorities:
  - Environmental aspects are systematically included in centralised contracts for the purchase and maintenance of service vehicles of the Flemish government.
  - A pilot project has been set up focused on ecodriving within the Flemish government.
  - Various demonstration projects have been and are being implemented concerning eco-friendly buses, followed by installation programmes for particle filters and deNOx installations.
- **Raising awareness and providing information**.The Ecoscore of each vehicle (new and second hand) can be consulted on the following website www.milieuvriendelijkvoertuig.be
- A number of **financial measures** should encourage private individuals and companies to purchase more environmentally friendly vehicles
  - Vehicles running on LPG benefit from tax reduction when taken into service
  - Since 1 august 2006, an ecology bonus is granted to companies for installing soot filters and for the purchase of heavy vehicles that already comply with the Euro V standard
- A number of projects seek to attain adapted driving behaviour by car and lorry drivers:
  - Ecodriving campaign for passengers cars and trucks
  - A pilot project which started in 2005 at 11 driving schools and examination centres.
  - A project started in 2006 addressed to companies

.
For more detailed information on these measures, we refer to the NEC programma that will be reported to the Commission by the end of 2006

3.2.6 Planned measures

Stationairy sources

In order to reduce the emission to the level of the NEC ceilings, additional measures are planned or taken into consideration for both NO_x and VOCs:

- obligation to implement a LDAR-programme in chemical industry and refineries (VOC);
- reduction of emissions in bulk storage in chemical industry and refineries and bulk terminals (VOC);
- strengthening of emissions limit values beyond obligation of the solvent directive for industrial sites with relative high emissions (printing industry, pharmaceutical industry, coating of textile, production of paint…) (VOC);
- company specific measures in the chemical industry (NO_x and VOC);
- company specific measures in the production of iron and steel and of non ferrous metals (NO_x);
- to discuss the lowering of the NO_x ceiling in the environmental policy agreement with electricity producers (NO_x);

Also the use of economic instruments (levy, tradable permits) is being studied and discussed in Flanders at this moment. Major attention is given to NO_x, but no decision has been taken yet.
For more detailed information on these measures, we refer to the NEC programma that will be reported to the Commission by the end of 2006.

Non-stationairy sources

- The Commuter Plan (2005) details the actions required with regard to **journeys to and from work**
- Optimising **freight transport** by enhancing transport efficiency
- Measures to stimulate the use of eco-friendly vehicles and fuels:
  - Disseminating a guide for the general public containing information on the Ecoscore and the eco-friendliness of vehicles
  - Working out an adjustment of the tax on new vehicles and the annual road tax for private cars. The vehicle's Ecoscore is used as the criterion for evaluating the vehicle's eco-friendliness. The vehicle's Ecoscore will be used in calculating the tax on new vehicles and annual road tax.
  - Working out an adjustment of the annual road tax due on lorries. A reduced road tax rate will be allocated to vehicles which meet a future standard at an early date. As an additional incentive for installing soot filters, a reduction is granted for the basic amount for vehicles fitted with such a filter.
  - Temporary speed limits on motorways along where the NO2 limit values are exceeded where people live at 300m or less from the motorway;
  - Gradual extension and optimised regulation of dynamic traffic control in relation to reducing instances in which the limit values for fine dust and NO2 are exceeded.

Attention is also being given to measures to reduce emissions in **inland waterway navigation**. Here, too, the main measures are in line with international requirements regarding emission standards. Financial incentives may ensure more rapid renewal of the fleet.
For more detailed information on these measures, we refer to the NEC programma that will be reported to the Commission by the end of 2006.

3.2.7 Publications, reports and other links
Belgian emission reduction programme, to be reported to the European Commission by the end of 2006

3.3 Plans and programmes for the zones Bew17s (Ardenne) and Bew18s (Wallonie III)

3.3.1 Responsible authorities

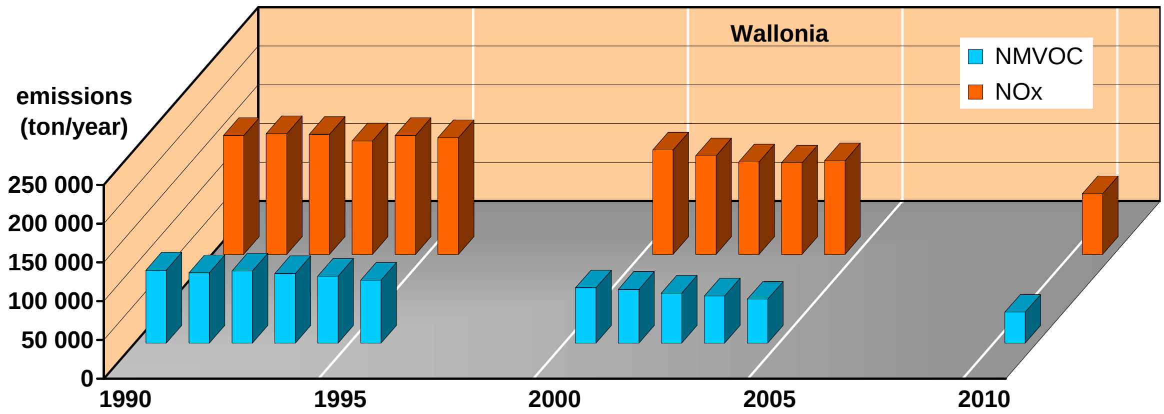
Th reposable administration for Air Qualit in Wallonia is

DGRNE
Cellule AIR
15 Av. Prince de Liège
B-5100 Jamber (Namur)

Contact person: Annick Fourmeax (A.Fourmeaux@mrw.wallonie.be)

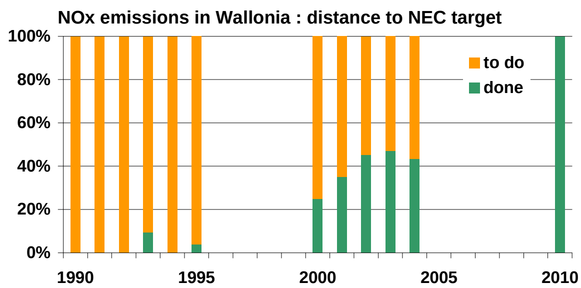
3.3.2 Follow up of NEC measures in Wallonia

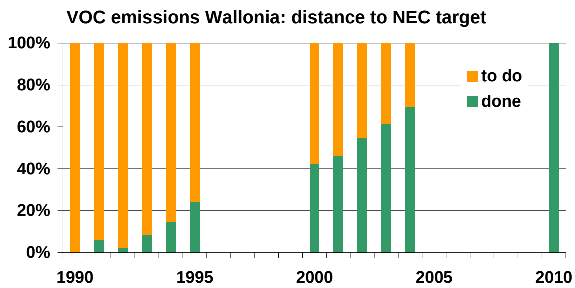
Actual status and NEC-goals in 2010 for the NOx and NMVOC emissions in Wallonia (1990, 2000 and 2004)



Source: NEC-report to the Commssion (December 2006)

Distance to NEC targets can be summarized as follows





3.3.3 Région wallonne de Belgique : Programme de lutte contre l'ozone - Mesures de réduction des précurseurs d'ozone, NOx et COV

Préambule

Attendu que la portée de ces précurseurs d'ozone s'étend aisément sur tout le territoire wallon, il n'est pas totalement nécessaire de distinguer des zones d'application sur lesquelles va s'appliquer le spectre des mesures recueillies dans le présent document.

Les mesures précitées seront essentiellement mises en œuvre dans la zone Bew 18s (Wallonie) mais auront un impact sur la zone Bew17s (Ardenne). Toutefois, il convient de distinguer certains projets tel que le nouveau métro de Charleroi qui sont des mesures plus particulièrement locales tandis que dans la zone Bew17s (Ardenne), il n'y a pas de grosse agglomération où des mesures plus locales seraient envisageables.

Par ailleurs, la zone Ardenne est essentiellement boisée; ce qui explique une partie des concentrations mesurées en ozone - paramètre difficile à maîtriser.

Enfin, le détail de toutes les mesures reprises ci-dessous figure dans le nouveau Plan wallon de l'Air 2007 ainsi que dans le Programme de réduction NEC pour la Région wallonne.

1. Région wallonne - Mesures de réduction des émissions de NOx

1.1. Mesures de programme de réduction NEC - Horizon 2010

1.1.1. WS 10 - Low-NOx burner in industrial processes and domestic sector
1.1.2. WS 11 - SNCR - Selective non Catalytic Reduction in some industrial processes
1.1.3. WS 12 - SCR - Selective Catalytic Reduction in some industrial processes
1.1.4. WS 13 - Minox system - device of reduction of NOx by combustion staged with a stage in reducing conditions "Minox" in some industrial processes
1.1.5. WS 14 - Standards of NOx emissions of the boilers of central heating < 400 kW in the Domestic Sector

1.2. Mesures du Plan de l'Air 2007

1.2.1. Fiche action n°22: Faire réfléchir le citoyen sur des modes de consommation ciblés.
1.2.2. Fiche action n°24: Offrir un service optimal dans les transports en commun afin de favoriser leur utilisation.
1.2.3. Fiche action n°25: Mettre en application la méthode ECOSCORE, prévoir des campagnes ciblées afin de diffuser l'information, conclure un accord de coopération avec le secteur, assurer l'affichage des scores dans les showrooms comme cela est le cas pour les appareils ménagers, négocier avec le Fédéral pour adopter.
1.2.4. Fiche action n°26: Mettre gratuitement à disposition le logiciel Mobipol pour permettre aux entreprises wallonnes d'exposer gratuitement leurs problèmes de mobilité.
1.2.5. Fiche action n°27: Favoriser le transfert "modal" vers le train et vers le co-voiturage pour les trajets longs (> 40 km).
1.2.6. Fiche action n°28: Favoriser les modes de transport doux par des infrastructures et le soutien aux initiatives permettant de les mettre en œuvre.
1.2.7. Fiche action n°29: Mettre en place le système de modulation des limitations de vitesse en fonction du niveau de pollution et veiller au respect des limitations de vitesse.
1.2.8. Fiche action n°32: Etablir un plan national de transport de marchandises et de personnes.

2. Région wallonne - Mesures de réduction des émissions de COV

2.1. Mesures du programme de réduction NEC - Horizon 2010

2.1.1. WS 15 - Storage & transport of fuel : Application of EC directive “Stage IA” - Sealed storage and recuperation of gasoline vapour during transfers - in the Energy supply sector
2.1.2. WS 16 - Distribution of gasoline : Application of EC directive “Stage IB” & II - Sealed storage and recuperation of gasoline vapour during car filling - in Energy Supply Sector

2.1.3. WS 17 - Vehicle refinishing :application of EC directive 2004/42/EC - Use of paints respecting solvent contents of directive - In industrial Process

2.1.4. WS 18 - Decorative paints : application of directive 2004/42/EC - Use of paints respecting solvent contents of directive

2.1.5. WS 19 - Wood painting : application of directive 1999/13/EC - Solvent management plans, use of low solvent substitutes… Application only in medium and large industries

2.1.6. WS 20 - Coating of metallic products : application of directive 1999/13/EC - Solvent management plans, use of low solvent substitutes… Application only in medium and large industries and where containment is possible

2.1.7. WS 21 - Metal degreasing : application of directive 1999/13/EC - Solvent management, good practice, substitution of techniques if feasible, cooling and protection of bath surfaces, … in medium and large enterprises

2.1.8. WS 22 - Dry cleaning : application of directive 1999/13/EC - Use of machines with solvent recycling - in the Domestic Sector

2.1.9. WS 23 - Pharmaceutical industry : application of solvent directive 1999/13/EC - Caption of effluents, adsorption and incineration - in Industrial Processes

2.1.10. WS 24 - Printing industry : application of solvent directive 1999/13/EC - Solvent management plan, control of fugitive emissions, use of water based products when feasible, abatement only when needed (large industries, roto – flexo-gravure or heliography) - in Industrial processes

2.1.11. WS 25 - Use of glues and adhesives : solvent directive 1999/13/EC - Use of low solvent products or substitutes, abatement if needed on large installations - in industrial processes

2.1.12. WS 26 - Wood protection reformulation - Product reformulation - in Industrial Process

2.1.13. WS 27 - Various polymers plants : inspections every 3 months - Inspections and preventive replacement of leaking parts of installation - In Industrial Process

2.1.14. WS 28 - Degreasing : good housekeeping in SMI’s - Basic rules of good housekeeping in small industries not concerned by the solvent directive - in Industrial Processes

2.1.15. WS 29 - Printing industry : solvent management plans - Solvent management plants to control fugitive emissions in small printing shops not concerned by the solvent directive (and often practicing coldest offset)

2.1.16. WS 30 - Domestic use of solvents : public information - Raise awareness of public on its consumption choices

2.2. Mesures du Plan de l'Air 2007

2.2.1. Fiche action n°22: Faire réfléchir le citoyen sur des modes de consommation ciblés.

3. RÉGION WALLONNE - MESURES DANS LE SECTEUR DES TRANSPORTS

Remarque préalable: ces mesures concernent plusieurs polluants et notamment les NOx et COV.

3.1. Mesures de programme de réduction NEC - Horizon 2010

3.1.1. WT 01 - Increasing support to urban transport

Brief description of policy or measure (or group)

- Increasing of capacity.
- Improvement of service quality, comfort, punctuality, commercial speed.
  Adjustment of the offer to the evolution of travelling and new needs.

3.1.2. WT 02 - Use of new technological solutions for urban transports

Brief description of policy or measure (or group)

- Purchase of new busses with low consumption and with reduced specific emission (a)
- Test of hybrid-busses (b)
- Installing of de-NOx systems on existing busses (c).

3.1.3. WT 03 - Development of intermodality by shifting the "TEC-group" into a mobility manager

Brief description of policy or measure (or group)

Shifting of the “TEC Group” (public transportation company) from a “bus services manager” into a “global mobility manager”, able to furnish to the user global mobility solutions (from the depart to the arrival).

3.1.4. WT 04 - Encouragement to use "non-motorised transports"

Brief description of policy or measure (or group)

- Infrastructure investments
- Support lent to initiatives relating to the use of “non-motorised transports”
- Global bicycle plans

3.1.5. WT 05 - Reduction of "long-distance journeys" made by car

Brief description of policy or measure (or group)

Encouragement (incentive) to the use of carpooling or train instead of cars for long-distance journey (way).

3.1.6. WT 06 - Encouragement to replace old pollutant cars by "green cars"

Brief description of policy or measure (or group)

- Replacement subsidies
- Lending without interest
- Sector related agreement for joint funding

3.1.7. WT 07 - Clean vehicles for public utilities fleets

Brief description of policy or measure (or group)

Imposing the purchase of “Green vehicles” by public utilities

3.1.8. WT 08 - Improvement of driver behaviour

Brief description of policy or measure (or group)

Firstly, specific formation for heavy-duty vehicles drivers.

3.1.9. WT 09 - Improvement of the respect of maximal speed

Brief description of policy or measure (or group)

Increase of the number of speed controls, notably by the installation of new fixed control systems. Firstly on highway.

3.1.10. WT 10 - Use of nitrogen for the filling of pneumatics

Brief description of policy or measure (or group)

Promote/prescribe the use of nitrogen for the filling of pneumatics.

3.1.11. WT 11 - Modification of regulations about "company-vehicles" to promote the use of "green cars"

Brief description of policy or measure (or group)

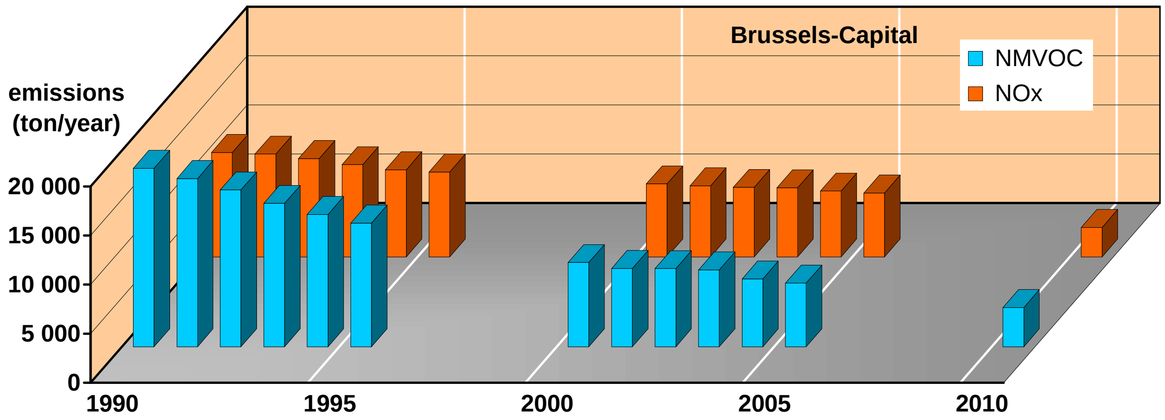
Company-vehicles are concerned by two federal regulations. These regulation could be modified to take into account specific NOx and COV emissions.

3.4 Measures in the Brussels-Capital Region and by the Federal State

Allthough not directly concerned by this report, the Brussels-Capital Region has taken own measures to attain the NEC-ceilings that were attributed to that region.

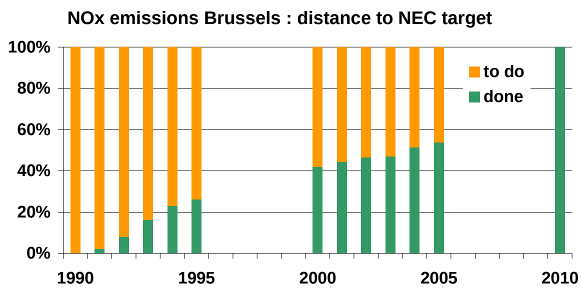
3.4.1 Brussels-Capital Region

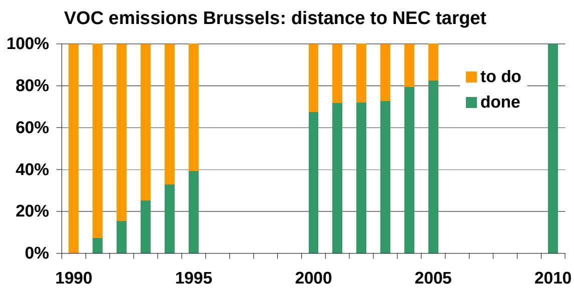
Follow-up of NEC reductions



Source: NEC-reporting to the Commission (December 2006)

Distance to go



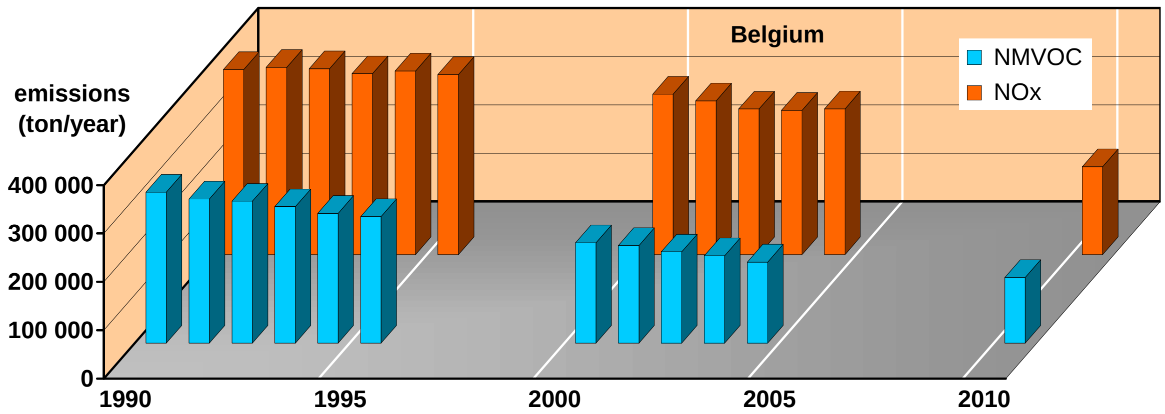


On 13 November 2002, The Government of the Brussels-Capital Region has adopted the "*Plan d'amélioration structurelle de la qualité de l'air et de lutte contre le réchauffement climatique; 2002 2010*". It can be downloaded at the website of the IBGE-BIM: http://be.sitestat.com/ibgebim/ibgebim/s?fr_le_plan_air_climat&ns_type=pdf

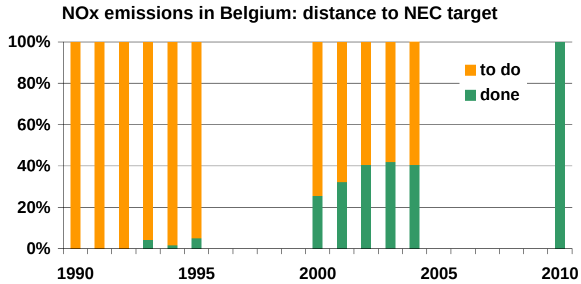
Among other objectives, the plan intends to abate ground level ozone in the Brussels-Capital Region.

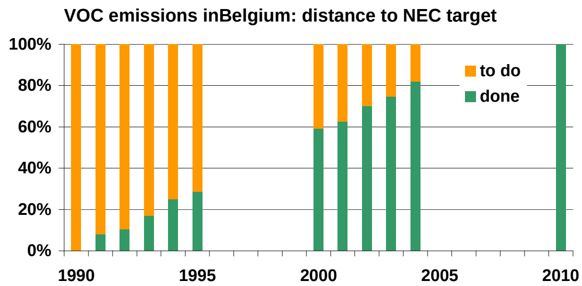
3.4.2 Belgium

Follow-up of NEC-reductions



Distances to go





As a whole, Belgium achieves approximately 40% of the NOx-reductions in 2004. NMVOC-reduction has already reached 80% of the total way to go.

In 2004 the Federal State of Belgium launched the "Ozone/heat"-plan in order to prevent or minimize the health dammage during summer epiisodes of heat and high ozone concentrations.

For the ozone/heat plan see
https://portal.health.fgov.be/pls/portal/docs/PAGE/INTERNET_PG/HOMEPAGE_MENU/MILIEU1_MENU/OZONE1_MENU/OZONE1_DOCS/FEDERAL%20OZONE%20PLAN%202004-2007.PDF

For the Federal ozone plan see
https://portal.health.fgov.be/pls/portal/docs/PAGE/INTERNET_PG/HOMEPAGE_MENU/MILIEU1_MENU/OZONE1_MENU/OZONE1_DOCS/PLAN_FED_OZONE_FR.PDF

Annex I

Spatial interpolation scheme : RIO

RIO ("Ruimtelijk Interpolatieschema voor Ozon")
The RIO model (Hooyberghs J, et al. 2006[2]) represents a spatial interpolation technique specially designed for spatially assessing ozone concentrations in ambient air. It is based on measured concentration data in (sparse) measuring locations. The major feature of the RIO-scheme is that it accounts in each individual gridcel of the interpolation domain for the site-specific photochemical equilibrium between formation and destruction of ozone. This site-specific equilibrium state is, in a densely populated region with dense traffic, mostly governed by the destruction of ozone through titration by nitric oxide (NO).

Relation between ozone and NO enables "detrending" before spatial interpolation
Measured ozone data show a clear trend due to titration by NO: areas with high NO-levels (such as inner cities or traffic locations) show definitely lower ozone concentrations than rural areas where the NO-levels are lower and the O_3 levels higher. The RIO-interpolation scheme first of all detrends the measured data according to the site-specific NO-titration. To achieve this goal the spatial nature of the NO_x pollution needs to be characterised. It turned out that the population density is very suitable for this purpose because the relation with the NO-titration effect is very stringent and secondly this population variable is, contrary to the NO_x data itself, readily available for a 5km x 5km grid. Therefore the population density is used as auxiliary data to remove this spatial trend due to the NO-titration.

Kriging based on spatial correlation determined by long time series of measurements
The residuals after detrending are then spatially interpolated by ordinary kriging to a 5 x 5 km grid. The ozone concentration at a given spot $\tilde{O}_3(\tilde{x})$ is a lineair combination of the ozone concentration at the monitoring sites $O_3(y_i)$:

$$\tilde{O}_3(\vec{x}) = \sum_{i=1}^{N} w_i(\vec{x}) O_3(\vec{y}_i) \quad (1)$$

In this method the weights $w_i(\tilde{x})$ of each monitoring site in the lineair estimator (1) at a given gridcell are statistically optimised by the use of a spatial correlation that has to be derived from the data. Usually it is assumed that this correlation only depends on the relative distance. This correlation is implicitly used to correctly assess the weight of correlated (clustered) monitoring sites. In ordinary kriging (like in estimations of ore concentrations for mining purposes) the correlations are estimated on the base of a multitude of measurements scattered over space. As for the ozone in ambient air there is not such a multitude of monitoring sites (*N* = only some 40 ozone monitoring sites for the whole of Belgium) the correlation functions have to be derived from a multitude of time sequences. For every pair of monitoring sites a spatial correlation between them can be calculated by averaging over many samples in time. A clear decay of the correlation as a function of the relative distance is observable. In the scope of this application (within a range of some 200 km) a linear decay-function can be used.
The outcome of the kriging interpolation to each gridcell is then "re-trended" according to the site-specific NO-titration strength which is again approximated by the site-specific population density.

Performance
The RIO model systematically improves the spatial interpolation compared to the conventional "inverse distance weighted" interpolation technique (IDW) for two reasons:

- first of all because the site-specific photochemical status is recognized: this results in lower ozone concentration where NO-concentration are high (e.g. in cities) and in higher ozone concentrations where NO-titration is less (e.g.in rural areas)

[2] Hooyberghs Jef , Mensink Clemens, Dumont Gerwin, Fierens Frans, Spatial interpolation of ambient ozone concentrations from sparse monitoring points in Belgium, *J. Environ. Monit.*, 2006, **8**, 1129 - 1135.

- secondly by the kriging interpolation itself which accounts for the (historical) correlations between the monitoring sites and is not merely based on relative distances.

The fact that both the detrending and the use of kriging improved the model is eminent from the RMS-error between observed and interpolated concentrations over a 6 years period, decreases from IDW (16.9) to RIO (11.4).

Results of *spatial averages* over Belgium of most ozone parameters (annual mean, $AOT40_{ppb}$, $NET60_{ppb}$, $SOMO35_{ppb}$, etc..) are rather equal for the two methods (IDW and RIO), hence the difference between the two models is a difference in ozone distribution rather than an overall bias. However this makes a significant difference when estimating *human exposure* to ozone, which is substantially lower when calculated by RIO than when estimated by IDW. This of course is due to the lower but much more realistic concentrations attributed by RIO to highly populated areas and agglomerations. Human exposure indexes to ozone in Belgium are some 10 to 15 % lower when derived with the RIO technique than based on an "inverse distance weighted" (IDW) interpolation.

Caveat

Site-specific ozone equilibrium depends on the site-specific NO levels. RIO approximates these levels by population density. Industrial zones, where population density might be low, are by this approximation considered as "more rural" and will see their ozone concentrations unrealistically upgraded. This is the case of the industrial zone of Antwerp-harbour in the North of Antwerp city. Introduction of more site-specific data, other than population density, such as land-use data (from CORINE) will help to overcome this error and to better evaluate the real NO-titration potential at industrial sites.

Annex II
Directive 2002/3/EC, Annex I Section II : Target values for ozone
Directive 2002/3/EC

ANNEX I

II. Target values for ozone

	Parameter	Target value for 2010 [(a)] [(1)]
1. Target value for the protection of human health	Maximum daily 8-hour mean [(b)]	120 µg/m³ not to be exceeded on more than 25 days per calendar year averaged over three years [(c)]
2. Target value for the protection of vegetation	AOT40, calculated from 1h values from May to July	18 000 µg/m³.h averaged over five years [(c)]

(a) Compliance with target values will be assessed as of this date. That is, 2010 will be the first year the data for which is used in calculating compliance over the following 3 or 5 years, as appropriate.

(b) The maximum daily 8-hour mean concentration shall be selected by examining 8-hour running averages, calculated from hourly data and updated each hour. Each 8-hour average so calculated shall be assigned to the day on which it ends. i.e. the first calculation period for any one day will be the period from 17:00 on the previous day to 01:00 on that day; the last calculation period for any one day will be the period from 16:00 to 24:00 on that day.

(c) If the three or five year averages cannot be determined on the basis of a full and consecutive set of annual data, the minimum annual data required for checking compliance with the target values will be as follows:

- for the target value for the protection of human health: valid data for one year
- for the target value for the protection of vegetation: valid data for three years.

(1) These target values and permitted exceedance are set without prejudice to the results of the studies and of the review, provided for in Article 11, which will take account of the different geographical and climatic situations in the European Community.

Annex III

Annex IV to Directive 96/62/EC

Directive 96/62/EC

ANNEX IV

INFORMATION TO BE INCLUDED IN THE LOCAL, REGIONAL OR NATIONAL PROGRAMMES FOR IMPROVEMENT IN THE AMBIENT AIR QUALITY

Information to be provided under Article 8 (3)

1. *Localization of excess pollution*
   - region
   - city (map)
   - measuring station (map, geographical coordinates).
2. *General information*
   - type of zone (city, industrial or rural area)
   - estimate of the polluted area (km^2) and of the population exposed to the pollution
   - useful climatic data
   - relevant data on topography
   - sufficient information on the type of targets requiring protection in the zone.
3. *Responsible authorities*

   Names and addresses of persons responsible for the development and implementation of improvement plans.
4. *Nature and assessment of pollution*
   - concentrations observed over previous years (before the implementation of the improvement measures)
   - concentrations measured since the beginning of the project
   - techniques used for the assessment.
5. *Origin of pollution*
   - list of the main emission sources responsible for pollution (map)
   - total quantity of emissions from these sources (tonnes/year)
   - information on pollution imported from other regions.
6. *Analysis of the situation*
   - details of those factors responsible for the excess (transport, including cross-border transport, formation)
   - details of possible measures for improvement of air quality.
7. *Details of those measures or projects for improvement which existed prior to the entry into force of this Directive i.e.*
   - local, regional, national, international measures
   - observed effects of these measures.
8. *Details of those measures or projects adopted with a view to reducing pollution following the entry into force of this Directive*
   - listing and description of all the measures set out in the project
   - timetable for implementation
   - estimate of the improvement of air quality planned and of the expected time required to attain these objectives.
9. *Details of the measures or projects planned or being researched for the long term.*
10. *List of the publications, documents, work, etc, used to supplement information requested in this Annex.*