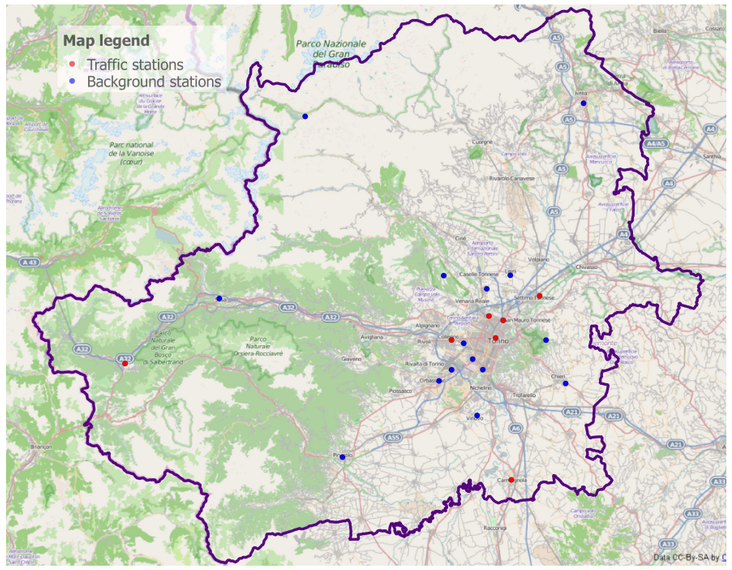
AIR QUALITY MONITORING NETWORK

The air quality monitoring network operating in the province of Turin is managed by Arpa Piemonte. It is composed of 23 monitoring stations (16 background stations and 7 traffic stations) and one mobile station for short measuring campaigns.

All the stations are connected to the data acquisition centre by telephone lines and transmit hourly measurement result. This setup allows a continuous monitoring of the main factors that may affect air quality.

Location of measurement stations on the territory is a key factor to achieve a cost-effective air quality monitoring. In some cases the selected sites must be representative of a large portion of territory, in other cases stations must represent specific pollution situation like traffic hot spot or single source emissions. A strategic location of measurement points gives extremely representative information on air quality.



A glance at our air

Annual report on data collected by provincial air quality monitoring network

2014 preview

Sergio Dall'Olio, sky above Torino 2014

MEASUREMENT STATIONS

Station	Address	Pollutants	Type of station
Baldissero (GDF)[1]	Str. Pino Torinese, 1 – Baldissero	NO_x, O_3, CO, PM10ß, PAHs depositometer	Rural background
Beinasco	Via S. Pellico, 5 – Beinasco	NO_x	Urban background
Beinasco (TRM) [1]	Via San Giacomo c/o giardino pubblico Aldo Mei - Beinasco	NO_x , PM10 , PM10 ß , PM2,5 ß, BTX, PCDD/DF sampling system, Metals/PAHs depositometer, Hg depositometer, PCDD/DF depositometer, Hg gaseous analyzer	Suburban background
Borgaro	Via Italia , sn – Borgaro	NO_x, O_3, PM10, PM2,5, (As-Cd-Ni-Pb), B(a)P, BTX	Suburban background
Carmagnola	P.zza I Maggio sn – Carmagnola	NO_x, CO, PM10, (As-Cd-Ni-Pb), B(a)P	Urban traffic
Ceresole Reale	c/o cent. Idroelettrica - Ceresole	NO_x, O_3,PM10ß, PM2,5ß, (As-Cd-Ni-Pb), B(a)P	Rural background
Chieri	Via Bersezio sn – Chieri	NO_x, O_3, PM2,5	Suburban background
Collegno	C.so Francia, 137 - Collegno	NO_x, PM10	Urban traffic
Druento	Cascina Peppinella – Druento	NO_x, O_3, PM10, (As-Cd-Ni-Pb), B(a)P	Rural background
Grugliasco	Viale Radich 8/12 - Grugliasco	NO_x, SO_2	Urban background
Ivrea	Viale della Liberazione, 1 – Ivrea	NO_x, O_3, PM10, PM2,5, (As-Cd-Ni-Pb), B(a)P	Suburban background
Leinì (GDF) [1]	Via vittime di Bologna, 12 - Leinì	NO_x, O_3, CO, PM10ß, PM2,5ß	Suburban background
Orbassano	Via Gozzano sn – Orbassano	NO_x, O_3	Suburban background
Oulx	Via Roma sn – Oulx	NO_x, CO, PM10, (As-Cd-Ni-Pb), B(a)P	Traffico-suburbano
Pinerolo	P.zza III Alpini, 1 – Pinerolo	NO_x, O_3	urban background
Settimo T.se	Via Milano, 31 – Settimo	NO_x, CO, PM10, PM2,5, BTX, B(a)P	Urban traffic
Susa	P.zza della Repubblica – Susa	NO_x, O_3, PM10, (As-Cd-Ni-Pb), B(a)P	Suburban background
TO-Consolata	Via Consolata, 10 – Torino	NO_x, CO, SO_2, PM10, (As-Cd-Ni-Pb), B(a)P, BTX, PTS	Urban traffic
TO-Grassi	Via P. Veronese, 305 – Torino	PM10, (As-Cd-Ni-Pb), B(a)P	Urban traffic
TO-Lingotto	Via A. Monti, 21 – Torino	NO_x, O_3, PM10-PM10ß, PM2,5, (As-Cd-Ni-Pb), B(a)P, BTX	Urban background
TO-Rebaudengo	P.zza Rebaudengo, 23 - Torino	NO_x, CO, SO_2, (As-Cd-Ni-Pb), B(a)P, BTX, PM10ß, PM2,5ß	Urban traffic
TO-Rubino	Via Rubino sn - Torino	NO_x, CO, PM10, (As-Cd-Ni-Pb), B(a)P, BTX, PM10ß, PM2,5ß	Urban background
Vinovo	Via Garibaldi, 3 – Vinovo	NO_x, O_3, BTX	Suburban background

[1] Station owned by private body managed by Arpa Piemonte

Pollutant	Description
As-Cd-Ni-Pb	Arsenic, Cadmium, Nickel, Lead
B(a)P	Benzo(a)pirene
BTX	Benzene, toluene, xilene
CO	Carbon monoxide
NO_X	Oxides of nitrogen
O_3	Ozone
PM10	Particulate matter < 10 µm
PM2,5	Particulate matter < 2,5 µm
PTS	Total particulate
SO_2	Sulphur dioxide

AIR QUALITY DATA
http://www.sistemapiemonte.it/ambiente/srqa/conoscidati.shtml

TURIN URBAN AREA AIR QUALITY FORECAST
http://www.provincia.torino.gov.it/ambiente/inquinamento/aria/qualita/ipqa/index

ANNUAL REPORTS
http://www.provincia.torino.gov.it/ambiente/inquinamento/eventi/sguardo
http://www.arpa.piemonte.it/approfondimenti/territorio/torino/aria/Pubblicazioni

PM10 REGIONAL FORECAST AND WEEKLY DATA BULLETINS
http://www.arpa.piemonte.it/bollettini

OZONE BULLETINS
http://www.arpa.piemonte.it/bollettini

All air quality data presented in tables and graphs were subjected to two out of three validation steps (daily, monthly and annual) of Arpa Piemonte Quality Management System. The 2014 edition of "A glance at our air" - which will be available for download at websites of Città Metropolitana di Torino and Arpa Piemonte - will include a circumstantial report on measurement data, further information on pollution sources and in-depth studies on specific issues.

AIR QUALITY IN THE PROVINCE OF TURIN

Data collected during the last 10 years by air quality monitoring network operating in the province of Turin and managed by Arpa Piemonte show an overall and significant improvement but at the same time confirm the critical situation of the territory, in particular of the Turin urban area.

Seven out of twelve regulated pollutants (CO, SO_2, Benzene, Pb, As, Cd, Ni) fully comply with the limits or target values throughout the province. Benzo(a)pyrene and PM2,5 show sporadic exceedances in the traffic monitoring station of the Turin urban area . In the same area nitrogen dioxide (NO_2) and PM10 most frequently exceed limit values. Data confirms that Ozone (O_3) is critical throughout the provincial territory.

Compliance with NO_2 annual limit value was observed in 80% of the measurement stations. The hourly limit value was fulfilled throughout the province.

As regards PM10, 93% of the monitoring stations comply with the annual limit value: the percentage drops to 43% in case of the daily limit value. In 2014 for the first time some suburban stations on the plain (e.g. Ivrea) complied with both the daily and annual limit while the annual mean of Consolata traffic station - which is located in the very centre of Turin - fell below 40 µg/m^3. Also PM2,5 showed an improvement because all stations fulfilled the annual limit value except for Settimo T.se.

Ozone target value for human health protection was exceeded in all measuring sites.

The highest levels of PM10, PM2,5 and NO_2 were found in Turin urban area, whereas rural areas showed the highest ozone concentration.

In 2014 a significant decrease in NO_2, PM10 and PM2,5 concentrations was observed. On the one hand this improvement is believed to be mainly due to a decrease of polluting emissions, connected with the reduction of energy consumption concerning car traffic and industrial production; on the other hand the decrease is associated with the unusually favourable dispersive atmospheric conditions during winter months.

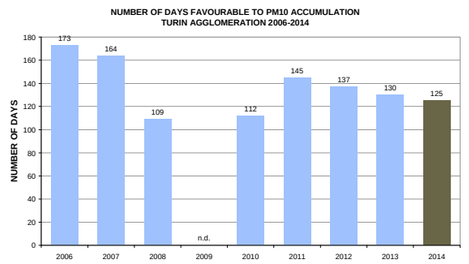
Pollutant	Situation
sulphur dioxide	All indicators concerning human health protection are fulfilled throughout the province of Turin.
carbon monoxide	
benzene	
lead	
Arsenic	
Cadmium	
nickel	
benzo(a)pirene	Most monitoring stations comply with the annual target for human health protection but a general increase in concentrations must be highlighted in comparison with previous years. Three traffic stations in Turin urban area exceed the target value.
nitrogen dioxide	The annual limit value concerning human health protection is exceeded in some traffic stations located in Turin urban area. The hourly limit value is fulfilled throughout the province of Turin.
PM10	The annual limit value concerning human health protection is substantially fulfilled all over the province. The hourly limit value is exceeded in Turin urban area.
PM2,5	The annual limit value concerning human health protection is substantially fulfilled all over the province.
ozone	The target limit value for the protection of human health is exceeded all over the province.

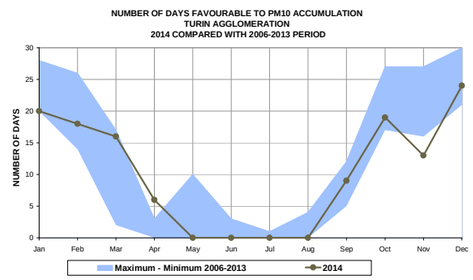
METEOROLOGY

Month	Temperature (°C)		Precipitation (mm)		Rainy days	
	mean 2014	mean 2004-2013	mean 2014	mean 2004-2013	mean 2014	mean 2004-2014
January	4,2	2,7	88	41	8	5
February	6,0	4,2	116	39	13	4
March	10,6	9,1	103	67	5	5
April	14,4	13,8	59	109	7	8
May	16,8	18,2	140	107	7	9
June	21,7	22,1	85	111	9	8
July	21,8	24,6	242	68	12	5
August	21,4	23,4	75	76	8	6
September	18,7	19,2	46	91	4	6
October	15,0	13,6	37	46	4	5
November	9,5	7,9	220	116	14	6
December	5,0	3,1	97	58	8	5
year	**13,8**	**13,5**	**1309**	**931**	**99**	**73**

The year 2014 was assessed by the index "number of days favourable to PM10 accumulation" from a meteorological viewpoint. The index, which is referred to Turin urban area, analyzes the interactions of transport, chemical transformation and dispersion of pollutants with meteorology. The aim of the index is to pick out the days when stability conditions favourable to PM10 increase occur. The index provides a useful tool to connect annual variability of pollutant concentrations and meteorology.

In 2014 the number of days favourable to PM10 accumulation was lower than in the previous 3 years. The monthly analysis of the index points out that the colder months of 2014 were less critical than the ones of the 2006-2013 period. In particular January and November show the lowest number of "critical days" in the period. Precipitation data confirm the index findings: 2014 was more rainy than 2006-2013 period, in terms of both total precipitation (1309 mm vs. 931 mm on the average), and number of rainy days (99 days versus 73 days on the average), especially in January, February, November and December.





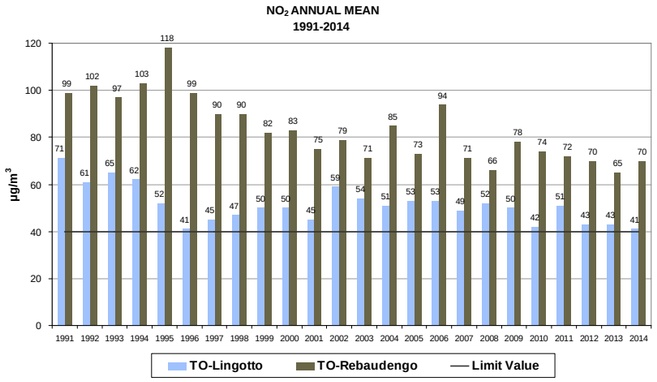
NITROGEN DIOXIDE

NO_2 2014	Annual mean (µg/m³)	Exceeding number
Baldissero	14	0
Beinasco	31	0
Beinasco TRM	38	0
Borgaro	26	0
Carmagnola	35	0
Ceresole	4	0
Chieri	23	0
Collegno	47	0
Druento	15	0
Grugliasco	37	2
Ivrea	24	0
Leini	30	0
Orbassano	32	0
Oulx	21	0
Pinerolo	28	0
Settimo	35	0
Susa	20	0
To-Consolata	58	1
To-Lingotto	41	0
To-Rebaudengo	70	0
To-Rubino	39	0
Vinovo	29	0

Limit values:
40 µg/m³ annual mean
200 µg/m³ hourly mean not to be exceeded more than 18 times a calendar year.

Nitrogen dioxide (NO_2) is considered one of the most dangerous air pollutant because it irritates the mucous membranes and it is a precursor of ozone and PM in photochemical processes. Diesel vehicles emission is the main source of NO_2 and its derivates.

In 2014 the annual limit value was exceeded in 7 out of 22 stations but only the traffic stations of To-Rebaudengo and To-Consolata showed very high values. All the monitoring stations complied with the hourly limit value; the 200 µg/m³ threshold was exceeded only twice in Grugliasco station and once in Torino-Consolata one. The time series displays a slight decrease in concentrations over the last 30 years.



PARTICULATE MATTER

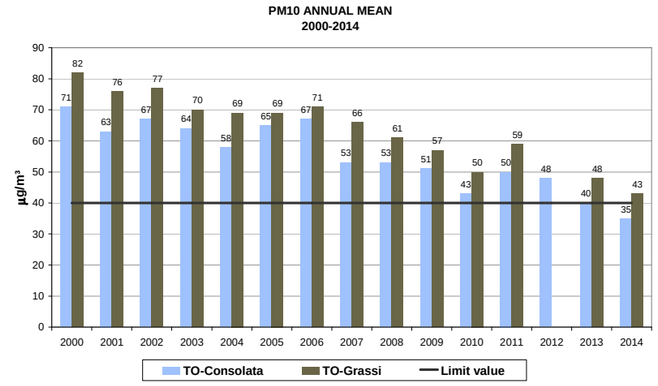
PM10 2014	Annual mean (µg/m³)	Exceeding number
Beinasco TRM (ß)	30	47
Borgaro	31	44
Carmagnola	36	82
Ceresole (ß)	5	0
Collegno	32	61
Druento	19	11
Ivrea	23	30
Leinì (ß)	25	35
Oulx	17	5
Settimo	34	81
Susa	16	1
To-Consolata	35	75
To-Grassi	43	77*
To-Lingotto	32	59
To-Rubino	31	58

*Underestimate because of low data capture
TO-Rebaudengo data still under validation

Valori limite:
40 µg/m³ annual average
50 µg/m³ daily mean not to be exceeded more than 35 times a calendar year

PM2,5 2014	Annual mean(µg/m³)
Beinasco TRM (ß)	23
Borgaro	23
Ceresole(ß)	4
Chieri	22
Ivrea	19
Settimo	26
To-Lingotto	24

Leinì data still under validation
Valore limite:
25 µg/m³ annual mean



Atmospheric particulate matter (PM) is microscopic solid (or liquid) matter suspended in the atmosphere. There is growing epidemiological evidence that exposure to PM may increase chronic diseases of breathing apparatus, in particular asthma, bronchitis and emphysema.

In 2014 PM10 annual limit value for the protection of human health was exceeded only in one measuring station (the highest values are measured in traffic stations), nevertheless the daily limit value was exceeded in 9 stations out of 15. Only the stations located in the alpine valleys usually comply with this limit value, whereas in 2014 flatlands stations of Ivrea and Druento fulfilled it. Also PM2,5 showed an improvement because all stations fulfilled the annual limit value (25 µg/m³) except for Settimo T.se.

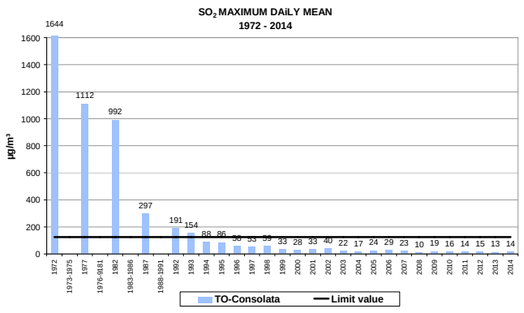
SULPHUR DIOXIDE

SO_2 2014	Annual mean (µg/m³)	Maximum hourly mean (µg/m³)
Grugliasco	7	25
To-Consolata	7	19
To-Rebaudengo	7	24

Limit values:
125 µg/m³ daily mean not to be exceeded more than 24 times a calendar year;
350 µg/m³ hourly mean not to be exceeded more than 24 times a calendar year.

Sulphur dioxide (SO_2) is the natural oxidation product of sulphur and compounds containing it. The main source is the combustion of fossil fuels like diesel oil , fuel oil and coal.

Time series analysis shows that ambient air concentrations of SO_2 have complied with the limit values for the last twenty years



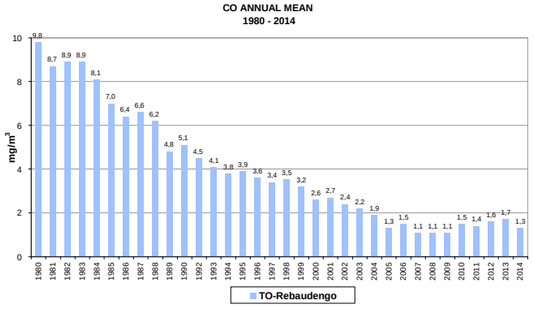
CARBON MONOXIDE

CO 2014	Annual mean (mg/m³)	Maximun 8h mean (mg/m³)
Baldissero	0,4	1,0
Carmagnola	0,5	1,8
Leinì	0,6	2,7
Oulx	0,6	1,9
Settimo	1,1	3,5
To-Consolata	1,3	3,8
To-Rebaudengo	1,3	3,2
To-Rubino	1,3	3,4

Limi value:
10 mg/m³ maximum daily 8 hour mean

Carbon monoxide (CO) is a colourless and odourless gas. It is mainly produced by the incomplete combustion of organic materials. The main source of CO is traffic and in particular gasoline vehicles.

Limit value is widely fulfilled. Time series analysis shows that CO concentrations have not substantially changed over the last 10 years, with annual means always below 2 mg/m³.



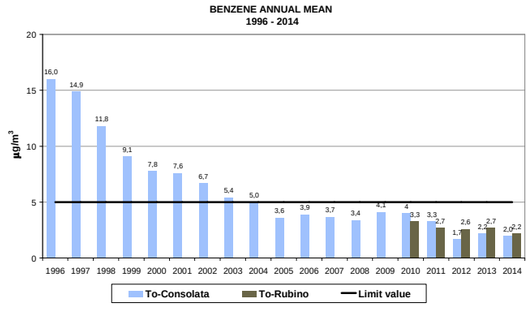
BENZENE

BENZENE 2014	Annual mean (µg/m³)
Beinasco (TRM)	2,2
Borgaro	1,4
Settimo	2,0
To-Consolata	2,0
To-Lingotto	1,0
To-Rebaudengo	2,5
To-Rubino	2,2
Vinovo	1,2

Limit value:
5 µg/m³ annual mean

Benzene (C_6H_6) is an aromatic hydrocarbon mainly emitted from gasoline cars. It is classified as carcinogenic belonging to EU category 1-R45.

Measuring data show in 2014 fully compliance with the limit value for the protection of human health. Data collected in 2014 confirm the slight but steady decrease of concentrations which has been observed for the last 5 years



BENZO(a)PYRENE

B(a)P 2014	Annual mean* (ng/m³)
Beinasco (TRM)	0,9
Borgaro	0,8
Carmagnola	0,9
Ceresole	0,1
Druento	0,3
Ivrea	0,8
Oulx	0,6
Settimo	1,4
Susa	0,6
To-Consolata	0,8
To-Grassi	1,2
To-Lingotto	0,8
To-Rebaudengo	1,2
To-Rubino	0,8

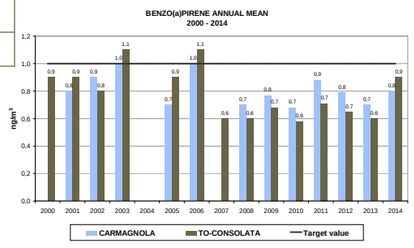
(*) Estimation based on the first 10 months of measurement

Target value:
1 ng/m³ annual mean

As regard the PAHs group, current legislation sets a target value only for benzo(a)pyrene. The IARC includes B(a)p in group 1, i.e."carcinogenic to humans".

The B(a)p 2014 annual means, estimated on the basis of first 10 months of measurement, are slightly higher than the one measured in previous years, especially in Turin urban area where 3 traffic stations are above the target value. Data will be confirmed when definitive annual means (including November and December measurements) will be available.

It's relevant to point out, as a partial explanation of the concentration increasing, that in January 2014 the percentages of B(a)P adsorbed on PM10 are twice as great in comparison with previous years. Further investigations and evaluations are ongoing.



HEAVY METALS

Metals 2014	As Annual mean* (ng/m³)	Cd Annual mean* (ng/m³)	Ni Annual mean* (ng/m³)	Pb Annual mean* (µg/m³)
Beinasco TRM	0,7	0,13	3,1	0,008
Borgaro	0,7	0,14	3,5	0,006
Carmagnola	0,7	0,13	2,9	0,005
Ceresole	0,7	0,09	1,1	0,001
Druento	0,7	0,09	1,6	0,004
Ivrea	0,7	0,13	2,3	0,005
Oulx	0,7	0,13	2,1	0,002
Susa	0,7	0,09	2,3	0,005
To-Consolata	0,7	0,16	5,2	0,008
To-Grassi	0,7	0,24	5,5	0,013
To-Lingotto PM10	0,7	0,13	3,5	0,007
To-Rebaudengo	0,7	0,26	4,9	0,014
To-Rubino	0,7	0,13	3,6	0,007

(*) Estimation based on the first 10 months of measurement

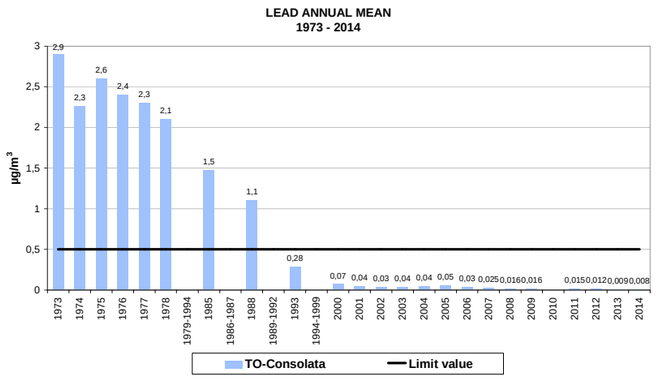
Limit value:
lead 0,5 µg/ m³ annual mean

Target value:
arsenic 6 ng/ m³ annual mean
cadmium 5 ng/ m³ annual mean
nickel 20 ng/ m³ annual mean

Heavy metals are a class of pollutants extremely widespread. Natural sources, like erosion or volcanic eruptions, can be the cause of their presence in air but also many human activities (traffic, metallurgical industry, combustion processes) have an important role. Heavy metals may affect human health in several ways depending on the kind of metal, the way of exposure and of course the quantity absorbed.

Nickel, Cadmium, Lead and Arsenic are metals with harmful effect on human health for which the Legislative Decree no. 155 of 13/08/2010 sets limit or target values.

These values are widely respected in all the monitoring sites for all metals. Time series shows that lead concentration in atmosphere have decreased around 300 times over the last 40 years and it is now stabilised at very low levels.



OZONE

O_3 2014	Number of exceedances of information threshold	Number of exceedances of the target value for the protection of human health
Baldissero	14	71
Borgaro	4	27
Ceresole	0	54
Chieri	9	43
Druento	26	60
Ivrea	1	31
Leinì	2	26
Orbassano	7	55
Pinerolo	0	29
Susa	0	29
To-Lingotto	9	39
Vinovo	4	41

information threshold :
180 µg/m³ hourly average
Target value for the protection human health:
120 µg/m³ maximum daily 8-hour mean not to exceed more than 25 days per calendar year averaged over three years

Ozone (O_3) is a secondary pollutant. It is formed through a series of photochemical reactions involving nitrogen oxides and volatile organic compounds. Low concentrations of O_3 may cause throat inflammation, breathing apparatus and eye irritation; higher concentrations can lead to respiratory function worsening.

The target value for the protection of human health (as an average for the last three years) is exceeded in all the monitoring stations of the province.

Time series essentially show a stability of the concentrations; annual variations are mainly due to different weather conditions.