

UBA-BE-015

**AUSTRIA –
OZONE IN 1992**

BERICHTE

AUSTRIA – OZONE IN 1992

**Report based on Statistics
according to the
EU Ozone Directive 92/72 EC**

UBA-BE-015

Wien, Juni 1994

**Bundesministerium für Umwelt,
Jugend und Familie**



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**Richtlinie 92/72/EWG des Rates vom 21. September 1992
über die Luftverschmutzung durch Ozon**

(ABLEG vom 13. 10. 1992 Nr. L297/1)

Anhang I

Schwellenwerte für die Ozonkonzentrationen in der Luft⁶

(Die Zahlenwerte sind in $\mu\text{g}/\text{m}^3$ angegeben. Die Volumenangabe gilt für folgende Temperatur- und Druckwerte: 293 Kelvin, 101,3 KPa.)

1. Schwellenwert für den Gesundheitsschutz
110 $\mu\text{g}/\text{m}^3$ als Mittelwert während acht Stunden⁷.
2. Schwellenwerte für den Schutz der Vegetation
200 $\mu\text{g}/\text{m}^3$ als Mittelwert während einer Stunde,
65 $\mu\text{g}/\text{m}^3$ als Mittelwert während 24 Stunden.
3. Schwellenwert für die Unterrichtung der Bevölkerung
180 $\mu\text{g}/\text{m}^3$ als Mittelwert während einer Stunde.
4. Schwellenwert für die Auslösung des Warnsystems
360 $\mu\text{g}/\text{m}^3$ als Mittelwert während einer Stunde.

6) Die Konzentrationen müssen kontinuierlich gemessen werden.

7) Der Mittelwert über acht Stunden ist gleitend ohne Überlappung; er wird viermal täglich anhand der acht Stundenwerte (0-9 Uhr, 8-17 Uhr, 16-1 Uhr, 12-21 Uhr) berechnet. Was die gemäß Artikel 6 Absatz 1 erster Gedankenstrich zu übermittelnden Angaben betrifft, so ist der Mittelwert über acht Stunden gleitend: Der arithmetische Mittelwert wird berechnet, indem der momentane Stundenwert h mit den vorangehenden sieben einzelnen Stundenwerten gemittelt wird.

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I.2 Types of stations

province	station	A	B	C
<i>Vienna</i>	Hermannskogel	+		
	Hohe Warte		+	
	Laaerberg		+	
	Lobau	+		
	Stephansplatz		+	
	Währinger Straße		+	
<i>Burgenland</i>	Illmitz	+		
<i>Lower Austria</i>	Amstetten		+	
	Annaberg	+		
	Exelberg	+		
	ForsthoF-Schöpfung	+		
	Gänserndorf		+	
	Großgöttfritz	+		
	Heidenreichstein	+		
	Hainburg		+	
	Irnfritz	+		
	Klosterneuburg		+	
	Kollmitzberg	+		
	Krems		+	
	Mistelbach		+	
	Mödling		+	
	Nebelstein	+		
	Ostrong	+		
	Pillersdorf	+		
	Schwechat		+	
	St.Leonhard a. Wald	+		
	St.Pölten		+	
Stixneusiedl	+			
Streithofen	+			
Ternitz		+		
Tulln			+	
Unterbergern	+			
Wolkersdorf		+		
Wr.Neustadt		+		
<i>Upper Austria</i>	Bad Ischl		+	
	Braunau			+
	Linz Berufsschulzentrum			+
	Lenzing		+	
	Mattighofen		+	
	Perg		+	

province	station	A	B	C
<i>Upper Austria</i>	Schöneben	+		
	Steyr		+	
	Steyregg-Weih		+	
	Traun		+	
<i>Salzburg</i>	Gaisberg Zistelalm	+		
	Hallein Rehhofsiedlung		+	
	Hallein Winterstall		+	
	Nußdorf am Haunsberg	+		
	Paß Lueg Zimmerau	+		
	Salzburg Lehen		+	
	Salzburg Sterneckstraße			+
	Sonnblick	+		
	St.Johann i. Pongau		+	
	St.Koloman		+	
	Zell a. See		+	
St.Michael i. Lungau		+		
<i>Styria</i>	Deutschlandsberg		+	
	Gaberl	+		
	Graz Platte	+		
	Graz West		+	
	Graz Schloßberg		+	
	Graz Süd		+	
	Grundlsee	+		
	Hochgössnitz	+		
	Judenburg		+	
	Leoben		+	
	Masenberg	+		
	Mürzzuschlag		+	
	Piber	+		
	Rennfeld	+		
	Salberg	+		
	Stolzalpe	+		
Voitsberg		+		
<i>Tyrol</i>	Gaimberg Zabernig	+		
	Innsbruck Andechstraße		+	
	Karwendel West	+		
	Kramsach Angerberg		+	
	Kufstein		+	
	Nordkette Seegrube	+		
	St.Johann i. Tirol		+	
	Wörgl Stelzhammerstraße		+	
	Zillertaler Alpen	+		

province	station	A	B	C
<i>Vorarlberg</i>	Bludenz Rathaus		+	
	Lustenau Wiesenrain		+	
	Sulzberg Gmeind	+		
<i>Carinthia</i>	Gerlitz	+		
	Klagenfurt-Koschatstraße		+	
	Klagenfurt-Kreuzbergl		+	
	Oberdrauburg			+
	Obervellach		+	
	Radenthein		+	
	Spittal a. d. Drau		+	
	St.Paul Herzogberg	+		
	St.Paul Johannesberg	+		
	St.Veit a. d. Glan		+	
	Villach			+
	Vorhegg	+		
	Völkermarkt			+
Wolfsberg-Hauptschule		+		

Note

- A Rural
- B Background urban
- C Curbside

I.3 Warning and Information System

The Warning and Information System in Austria is regulated by the so called "Ozone Law", FLG 210/1992 which entered into force at May 1, 1992.

The Warning and Information System can be described as follows:

- The whole country is divided into 7 ozone monitoring regions, the local governments and the Federal Environmental Agency being responsible for running a network of continuous monitoring ozone stations. In 1992 135 ozone stations have been in operation. Ordinance FLG 175/1992 regulates the exact boundaries of these regions; ordinance FLG 677/1992 regulates the details of the monitoring network (minimum number of monitoring sites; specification of monitoring instruments etc.).
- As soon as one of the three thresholds exceedances occur at two or more stations located within an ozone monitoring region and if it has to be assumed that the meteorological situation will favour such exceedances also the next day the local governor has to announce the corresponding warning level and inform the public (see also I.3.3). Ordinance FLG 175/1992 regulates the information which has to be provided to the public depending on the warning level.
- As the ozone monitoring regions and the Austrian provinces are not identical a computerized network for fast data exchange between network operators is in operation since April 1994.
- There have been introduced three threshold levels (see item I.3.1).

- In addition to the information of the public the local governor can introduce emission reduction measures (e.g. reduction of traffic) if the warning levels I or II are exceeded (see also I.3.2).

I.3.1 Limit values

The following warning levels for ozone have been defined, the values being three hour average values:

	ppb	mg/m ³
prewarning level	100	0,200
warning level I	150	0,300
warning level II	200	0,400

The Ozone Law states that measures will be taken before the concentrations of 150 and 200 ppb are reached; these concentration thresholds are:

measures for level I	130	0,260
measures for level II	180	0,360

I.3.2 Measures

- a) prewarning level
 - o Information of the public

Information text:

Such enhanced ozone concentrations can induce irritations of the phlegm and result in difficulties in breathing. As a precaution people being very sensitive - e.g. children

with oversensitive bronchia, people with heavy sickness of respiratory tract and/or the heart, astmatics - should avoid unusual or heavy efforts outside, especially during midday or in the afternoon. Usual activities outside like walking, bathing or picknick is harmless also for very sensitive people.

This information is usually part of the news in radio and television; in addition the public is informed about the area which is affected by such high ozone concentrations.

- o Preparation of a study to identify the long-term emission control measures necessary to avoid exceedances of the prewarning threshold in the future

b) warning level I

- o Information of the public

Information text:

Such enhanced ozone concentrations can induce irritations of the phlegm and result in difficulties in breathing. People being very sensitive - e.g. children with oversensitive bronchia, people with heavy sickness of respiratory tract and/or the heart, astmatics - should stay inside in non-smoking areas. Healthy people should avoid unusual or heavy efforts outside, especially during midday or in the afternoon. For individual, health related information it is recommended to contact the family doctor.

- o Enactment of short-term emission control measures

The local governor has to enact short-term emission reduction measures with respect to nitrogen oxides and volatile organic compounds; these measures have to be limited in space and time and may include traffic

regulations, emission reductions for stationary sources, limitations of the use of organic solvents and prohibition of burning biogenic materials outside.

c) Warning level II

o Information of the public

Information text:

Such enhanced ozone concentrations can induce irritations of the phlegm and result in difficulties in breathing. It is recommended that all persons should stay inside in non-smoking areas. Unusual or heavy efforts outside, especially during midday or in the afternoon, should be avoided. For individual, health related information it is recommended to contact the family doctor.

o Enactment of short-term emission control measures

The local governor has to enact short-term emission reduction measures with respect to nitrogen oxides and volatile organic compounds; these measures have to be limited in space and time and may include traffic regulations, emission reductions for stationary sources, limitations of the use of organic solvents and prohibition of burning biogenic materials outside..

o Prohibition of outside activities of schools and kindergarten like walking tours and sports.

I.3.3 Information of the public

o teletext information

There is provided a regular daily information of the public via teletext of the maximum 3-hour average value of

each ozone monitoring region.

This information is updated on an hourly basis if one of the warning levels is exceeded.

- o Each province in Austria provides additional information via telephone for a more regional information.
- o Many newspapers report daily about the ozone level.
- o The public is informed about the occurrence of a warning level in the news sended by radio and/or television.

II. Measurement results

II.1 Exceedances of thresholds

The data given correspond to the period from April 1 to September 30, 1992.

province	station	> 65 µg/m ³	>110 µg/m ³	>180 µg/m ³	>200 µg/m ³	>360 µg/m ³
		24hr average*	8hr average*	1hr average*	1hr average*	1hr average*
		days	days	days	days	days
<i>Vienna</i>	Hermannskogel	143	91	8	6	-
	Hohe Warte	26	31	4	3	-
	Laaerberg	50	33	4	2	-
	Lobau	61	51	3	1	-
	Stephansplatz	41	51	3	3	-
	Währinger Straße	30	23	3	3	-
<i>Burgenland</i>	Illmitz	151	102	9	1	-
<i>Lower Austria</i>	Amstetten	31	46	5	2	-
	Annaberg	119	65	2	-	-
	Exelberg	178	120	9	7	1
	ForsthoF-SchöpfI	142	76	2	1	-
	Gänserndorf	50	45	5	3	-
	Großgöttfritz	73	32	3	1	-
	Heidenreichstein	52	37	-	-	-
	Hainburg	111	86	5	2	-
	Irnfritz	94	39	3	-	-
	Klosterneuburg	64	45	5	4	-
	Kollmitzberg	91	60	2	2	-
	Krems	24	22	3	2	-
	Mistelbach	89	54	3	1	-
	Mödling	93	64	6	1	-
	Nebelstein	121	59	4	-	-
	Ostrong	126	86	5	3	-
	Pillersdorf	150	89	9	2	-
	Schwechat	3	1	-	-	-
	St.Leonhard a. Wald	102	69	7	4	-
	St.Pölten	35	47	6	4	-
	Stixneusiedl	132	83	3	-	-
	Streithofen	31	40	6	5	-
	Ternitz	98	56	-	-	-
Tulln	24	35	5	3	-	
Unterbergern	95	67	6	4	-	
Wolkersdorf	104	63	2	2	-	
Wr.Neustadt	68	55	-	-	-	
<i>Upper Austria</i>	Bad Ischl	74	54	1	-	-
	Braunau	30	22	-	-	-
	Linz Berufsschulz.	60	51	5	1	-
	Lenzing	117	75	2	-	-
	Mattighofen	98	74	5	-	-

province	station	> 65 µg/m ³	> 110 µg/m ³	> 180 µg/m ³	> 200 µg/m ³	> 360 µg/m ³
		24hr average*	8hr average*	1hr average*	1hr average*	1hr average*
		days	days	days	days	days
<i>Upper Austria</i>	Perg	53	50	4	1	-
	Schöneben	163	89	3	-	-
	Steyr	47	31	-	-	-
	Steyregg-Weih	110	88	8	2	-
	Traun	75	78	10	-	-
<i>Salzburg</i>	Gaisberg Zistelalm	165	112	1	-	-
	Hallein Rehhofsiedlung	33	13	-	-	-
	Hallein Winterstall	115	55	1	-	-
	Nußdorf am Haunsberg	154	84	3	-	-
	Paß Lueg Zimmerau	57	44	2	1	-
	Salzb. Lehen	87	68	3	1	-
	Salzb. Sternecksstraße	42	25	1	-	-
	Sonnblick	160	108	-	-	-
	St.Johann i. Pongau	23	27	-	-	-
	St.Koloman	157	76	1	1	-
	Zell a. See	36	13	-	-	-
St.Michael i. Lungau	54	40	-	-	-	
<i>Styria</i>	Deutschlandsberg	68	63	-	-	-
	Gaberl	115	62	-	-	-
	Graz Platte	150	111	2	-	-
	Graz West	25	23	-	-	-
	Graz Schloßberg	101	51	-	-	-
	Graz Süd	52	71	-	-	-
	Grundlsee	95	37	-	-	-
	Hochgössnitz	110	58	-	-	-
	Judenburg	1	4	-	-	-
	Leoben	16	21	-	-	-
	Masenberg	137	82	-	-	-
	Mürzzuschlag	15	23	-	-	-
	Piber	120	86	2	-	-
	Rennfeld	139	111	-	-	-
	Salberg	141	58	-	-	-
	Stolzalpe	134	73	-	-	-
Voitsberg	35	59	-	-	-	
<i>Tyrol</i>	Gaimberg Zabernig	128	44	-	-	-
	Innsbruck Andechstr.	28	29	-	-	-
	Karwendel West	171	98	1	-	-
	Kramsach Angerberg	69	47	1	1	-
	Kufstein	34	29	1	1	-
	Nordkette Seegrube	163	78	-	-	-
	St.Johann i. Tirol	19	22	-	-	-
	Wörgl Stelzhammerstr.	28	36	1	1	-
	Zillertaler Alpen	162	78	-	-	-

province	station	> 65 µg/m ³	>110 µg/m ³	>180 µg/m ³	>200 µg/m ³	>360 µg/m ³
		24hr average*	8hr average*	1hr average*	1hr average*	1hr average*
		days	days	days	days	days
<i>Vorarlberg</i>	Bludenz Rathaus	36	36	1	-	-
	Lustenau Wiesenrain	54	44	1	-	-
	Sulzberg Gmeind	157	89	3	-	-
<i>Carinthia</i>	Gerlitz	153	126	2	-	-
	Klagenfurt-Koschatstr.	70	56	-	-	-
	Klagenf. Kreuzbergl	110	76	-	-	-
	Oberdrauburg	48	45	3	2	-
	Obervellach	44	28	-	-	-
	Radenthein	29	29	-	-	-
	Spittal a. d. Drau	39	36	-	-	-
	St.Paul Herzogberg	107	82	-	-	-
	St.Veit a. d. Glan	11	6	-	-	-
	Villach	44	39	-	-	-
	Vorhegg	155	107	3	-	-
	Völkermarkt	4	6	-	-	-
Wolfsberg-Hauptschule	21	15	-	-	-	

* running average; interval 30 min.

II.2. median, 98-percentiles and maxima

These values are given for the period April 1 to September 30, 1992

province	station	1hr average $\mu\text{g}/\text{m}^3$			8hr average		
		P50	P98	max	P50	P98	max
<i>Vienna</i>	Hermannskogel	88	160	328	88	154	220
	Hohe Warte	58	138	282	62	126	192
	Laaerberg	60	134	242	60	126	178
	Lobau	64	142	212	66	130	172
	Stephansplatz	62	140	288	66	130	208
	Währinger Straße	38	126	288	34	118	204
<i>Burgenland</i>	Illmitz	78	158	202	82	148	174
<i>Lower Austria</i>	Amstetten	40	146	228	44	132	194
	Annaberg	80	140	198	82	136	156
	Exelberg	100	168	418	98	164	248
	ForsthoF-SchöpfI	88	146	214	88	140	176
	Gänserndorf	60	138	222	64	130	188
	Großgöttfritz	68	136	212	70	132	180
	Heidenreichstein	62	136	168	64	130	182
	Hainburg	76	152	228	76	144	178
	Imfritz	72	144	198	72	140	170
	Klosterneuburg	48	144	300	52	136	190
	Kollmitzberg	72	142	206	74	128	182
	Krems	40	124	212	44	114	172
	Mistelbach	68	138	202	70	130	164
	Mödling	74	146	210	74	138	178
	Nebelstein	84	150	200	86	148	180
	Ostrong	84	160	242	88	154	103
	Pillersdorf	82	154	218	84	148	180
	Schwechat	42	94	136	44	86	114
	St.Leonhard a. Wald	78	158	252	78	154	112
	St.Pölten	50	144	256	54	134	200
	Stixneusiedl	80	150	200	80	142	180
	Streithofen	48	142	268	56	136	184
Ternitz	76	142	180	74	136	162	
Tulln	38	144	266	44	134	174	
Unterbergern	70	152	240	74	144	212	
Wolkersdorf	72	142	162	74	136	144	
Wr.Neustadt	64	142	178	66	124	164	
<i>Upper Austria</i>	Bad Ischl	58	138	182	60	126	172
	Braunau	48	122	154	48	112	138
	Linz Berufsschulzentrum	48	148	208	50	138	184
	Lenzing	74	148	198	74	138	174
	Mattighofen	66	158	190	68	140	176
	Perg	50	148	224	52	136	180

province	station	1hr average $\mu\text{g}/\text{m}^3$			8hr average		
		P50	P98	max	P50	P98	max
<i>Upper Austria</i>	Schöneben	92	154	196	92	148	178
	Steyr	50	136	178	50	122	150
	Steyregg-Weih	76	158	206	74	150	196
	Traun	62	100	196	62	144	182
<i>Salzburg</i>	Gaisberg Zistelalm	50	150	198	100	148	174
	Hallein Rehhofsiedlung	36	116	150	38	106	130
	Hallein Winterstall	72	144	182	72	134	166
	Nußdorf am Haunsberg	86	150	196	86	144	180
	Paß Lueg Zimmerau	46	142	206	48	128	154
	Salzburg Lehen	58	150	202	58	140	176
	Salzburg Sterneckstraße	38	128	182	42	116	156
	Sonnblick	106	140	160	106	138	150
	St.Johann i. Pongau	40	126	144	42	112	142
	St.Koloman	92	146	208	90	140	170
	Zell a. See	46	116	158	46	106	126
	St.Michael i. Lungau	54	130	174	54	120	168
<i>Styria</i>	Deutschlandsberg	54	144	174	58	132	154
	Gaberl	86	142	162	88	140	152
	Graz Platte	98	154	190	96	148	170
	Graz West	10	122	148	20	112	136
	Graz Schloßberg	70	142	164	70	136	158
	Graz Süd	50	146	176	54	134	158
	Grundlsee	78	128	162	80	124	150
	Hochgössnitz	84	140	178	84	138	160
	Judenburg	12	116	160	36	110	138
	Leoben	26	130	172	36	110	150
	Masenberg	94	152	180	96	150	174
	Mürzzuschlag	46	126	158	50	118	134
	Piber	80	150	182	82	144	166
	Rennfeld	102	154	180	104	150	164
	Salberg	88	134	158	90	130	152
	Stolzalpe	86	136	164	86	132	152
	Voitsberg	34	146	178	44	134	170
<i>Tyrol</i>	Gaimberg Zabernig	78	134	166	78	132	144
	Innsbruck Andechstraße	40	124	172	42	114	140
	Karwendel West	100	144	188	100	142	172
	Kramsach Angerberg	52	132	206	54	124	168
	Kufstein	38	128	202	40	116	162
	Nordkette Seegrube	94	134	144	96	134	148
	St.Johann i. Tirol	40	122	170	42	112	146
	Wörgl Stelzhammerstraße	40	130	202	40	118	168
	Zillertaler Alpen	98	136	158	98	134	146

province	station	1hr average $\mu\text{g}/\text{m}^3$			8hr average		
		P50	P98	max	P50	P98	max
<i>Vorarlberg</i>	Bludenz Rathaus	40	134	182	42	122	162
	Lustenau Wiesenrain	52	138	186	52	126	172
	Sulzberg Gmeind	92	154	182	92	148	172
<i>Carinthia</i>	Gerlitz	108	154	188	108	152	162
	Klagenfurt-Koschatstraße	46	134	174	54	124	152
	Klagenfurt-Kreuzbergl	74	138	180	76	130	152
	Oberdrauburg	58	140	210	62	132	160
	Obervellach	50	124	144	54	116	148
	Radenthein	46	126	148	52	116	138
	Spittal a. d. Drau	50	134	172	54	122	162
	St.Paul Herzogberg	74	144	178	74	136	156
	St.Veit a. d. Glan	42	112	140	44	102	134
	Villach	38	128	162	46	118	146
	Vorhegg	88	148	200	90	146	176
	Völkermarkt	32	110	146	38	100	132
	Wolfsberg-Hauptschule	46	122	162	50	112	144

II.3 Periods with exceedances

Population warning threshold

date	station	concentration [$\mu\text{g}/\text{m}^3$]
31.07.	Exelberg	418

Population information threshold

date	station	concentration [$\mu\text{g}/\text{m}^3$]
07.05.	Mattighofen	184
	Schöneben	184
08.05.	Oberdrauburg	210
	Vorhegg	200
	Hainburg	196
09.05.	Oberdrauburg	190
	Gerlitzten	184
10.05.	Oberdrauburg	190
	Gerlitzten	184
	Vorhegg	182
22.06.	Mödling	186
30.06.	Karwendel West	188
01.07.	St. Leonhard am Wald	208
	Kollmitzberg	206
	Linz Berufsschulzentrum	192
	Amstetten	190
	Perg	186
	Salzburg Lehen	186
	Traun	186
	Paß Lueg Zimmerau	184
	Steyregg	184
	Nußdorf am Haunsberg	182

date	station	concentration [µg/m ³]
17.07.	Stixneusiedl	200
21.07.	Linz Berufsschulzentrum	208
	Steyregg	206
	Traun	194
	Mattighofen	190
	Nußdorf am Haunsberg	184
27.07.	Exelberg	240
	Klosterneuburg	228
	Hermannskogel	224
	Wolkersdorf	212
	Streithofen	208
	Mistelbach	202
	Hohe Warte	200
	Ostrong	194
	Tulln	194
	Gänserndorf	192
	Mödling	186
	St. Leonhard am Wald	186
	Perg	186
	Amstetten	184
	Laaer Berg	182
	Steyregg	182
30.07.	Perg	224
	Exelberg	218
	Amstetten	212
	Ostrong	212
	St. Leonhard am Wald	206
	Steyregg	198
	Schöneben	196
	Traun	194
	Hermannskogel	190
	Nebelstein	190
	Pillersdorf	190
	Linz Berufsschulzentrum	196
31.07.	Exelberg	418
	Hermannskogel	328
	Klosterneuburg	300
	Stephansplatz	288
	Währinger Str.	288
	Hohe Warte	282
	Tulln	266
	Laaer Berg	242
	Streithofen	234
	Hainburg	228
	Gänserndorf	222
	Lobau	212
	Mödling	210
	Kramsach	206

date	station	concentration [ug/m ³]
31.07.	Kufstein	202
	Salzburg Lehen	202
	Woergl	202
	Gaisberg Zistelalm	198
	Lenzing	198
	Nußdorf am Haunsberg	196
	Graz Platte	190
	St. Pölten	188
	Annaberg	186
	Pillersdorf	186
	Bad Ischl	182
	Hallein Winterstall	182
	Nebelstein	182
	Salzburg Sterneckerstr.	182
	Steyregg	182
Traun	182	
Unterbergern	182	
01.08.	Gänserndorf	204
	Lobau	184
03.08.	Pillersdorf	200
06.08.	Tulln	260
	Exelberg	242
	Streithofen	242
	Währinger Str.	240
	Unterbergern	234
	Hohe Warte	230
	Stephansplatz	230
	St. Pölten	228
	Hermannskogel	220
	Großgoettfritz	212
	Krems	212
	Klsterneuburg	202
	Hainburg	200
	Nebelstein	200
Ostrong	200	
07.08.	Irnfritz	198
	Pillersdorf	184
	Mistelbach	182
	Exelberg	280
	Hermannskogel	272
	Streithofen	268
	St. Pölten	256
	St. Leonhard am Wald	252
Unterbergern	240	
Ostrong	232	
Stephansplatz	228	

date	station	concentration [µg/m ³]
07.08.	Währinger Str.	224
	Hainburg	220
	Wolkersdorf	218
	Hohe Warte	216
	Laaer Berg	212
	Klosterneuburg	208
	Amstetten	200
	Irnfritz	198
	Mödling	198
	Steyregg	196
	Tulln	196
	Großgöttfritz	194
	Nebelstein	194
	Lobau	192
	Mattighofen	190
	Perg	190
	Pillersdorf	190
	Traun	190
	Linz Berufsschulzentrum	186
	Salzburg Lehen	184
Stixneusiedl	184	
Gänserndorf	182	
08.08.	Pillersdorf	202
	Unterbergern	200
	Exelberg	188
	Mattighofen	188
	Traun	186
09.08.	Traun	182
10.08.	Schöneben	188
	St. Leonhard am Wald	182
	Traun	180
18.08.	Exelberg	198
	Mödling	186
	Hermannskogel	182
19.08.	Gänserndorf	202
	Hainburg	196
	St. Leonhard am Wald	190
	Mistelbach	188
	Pillersdorf	184
	Forsthof	182

date	station	concentration [µg/m]
20.08.	St. Leonhard am Wald	252
	Ostrong	242
	Unterbergern	240
	St. Pölten	226
	Amstetten	224
	Tulln	218
	Forsthof-Schöpfl	214
	Hermannskogel	210
	St. Koloman	208
	Paß Lueg Zimmerau	206
	Steyregg	106
	Streithofen	202
	Großgöttfritz	200
	Annaberg	198
	Linz Berufsschulzentrum	198
	Mödling	192
	Krems	190
	Traun	190
	Stixneusiedl	190
	Mattighofen	188
26.08.	Laaer Berg	186
	Klosterneuburg	184
	Piber	182
26.08.	Exelberg	220
	Hermannskogel	220
	Graz Platte	182
28.08.	Unterbergern	234
	Pillersdorf	218
	Krems	212
	St. Pölten	206
	Steyregg	196
	Traun	196
	Streithofen	192
	Irnfritz	184
Piber	180	
29.08.	Kollmitzberg	204
08.09.	Vorhegg	182

II.4 Duration of exceedances

The data given correspond to the period from April 1 to September 30, 1992.

province	station	>110µg/m ³ 8hr average* hours	>180µg/m ³ 1hr average* hours	>360µg/m ³ 1hr average* hours
<i>Vienna</i>	Hermannskogel	1033,5	34,0	0
	Hohe Warte	228,5	15,5	0
	Laaerberg	241,5	7,5	0
	Lobau	336,0	6,0	0
	Stephansplatz	319,5	11,5	0
	Währinger Straße	135,5	11,0	0
<i>Burgenland</i>	Illmitz	755,5	12,0	0
<i>Lower Austria</i>	Amstetten	264,0	14,5	0
	Annaberg	654,0	2,5	0
	Exelberg	1486,0	45,5	1,5
	ForsthoF-Schöpfl	798,5	3,5	0
	Gänserndorf	336,0	11,0	0
	Großgöttfritz	326,5	6,0	0
	Heidenreichstein	299,5	0	0
	Hainburg	709,0	13,0	0
	Irnfritz	362,5	5,0	0
	Klosterneuburg	361,0	22,0	0
	Kollmitzberg	558,0	6,0	0
	Krems	124,0	8,0	0
	Mistelbach	379,0	4,5	0
	Mödling	487,5	13,5	0
	Nebelstein	780,0	7,0	0
	Ostrong	1056,0	28,5	0
	Pillersdorf	785,5	21,5	0
	Schwechat	2,5	0	0
	St.Leonhard a. Wald	916,0	32,5	0
	St.Pölten	303,5	20,5	0
	Stixneusiedl	706,0	7,5	0
	Streithofen	390,5	15,5	0
Ternitz	417,0	1,0	0	
Tulln	260,5	13,0	0	
Unterbergern	531,0	23,0	0	
Wolkersdorf	488,5	8,5	0	
Wr.Neustadt	396,0	0	0	
<i>Upper Austria</i>	Bad Ischl	300,0	1,0	0
	Braunau	98,0	0	0
	Linz Berufsschulzentrum	346,5	16,0	0
	Lenzing	540,0	5,0	0
	Mattighofen	524,0	15,5	0
	Perg	313,5	10,5	0

province	station	>110µg/m ³ 8hr average* hours	>180µg/m ³ 1hr average* hours	>360µg/m ³ 1hr average* hours
<i>Upper Austria</i>	Schöneben	1049,5	7,5	0
	Steyr	158,0	0,5	0
	Steyregg-Weih	737,0	31,5	0
	Traun	483,5	28,0	0
<i>Salzburg</i>	Gaisberg Zistelalm	1511,5	2,5	0
	Hallein Rehhofsiedlung	47,5	0	0
	Hallein Winterstall	435,5	0,5	0
	Nußdorf am Haunsberg	842,5	7,0	0
	Paß Lueg Zimmerau	287,0	2,5	0
	Salzburg Lehen	479,5	6,5	0
	Salzburg Sterneckstraße	123,5	1,5	0
	Sonnblick	1873,0	0	0
	St.Johann i. Pongau	109,5	0	0
	St.Koloman	859,0	4,0	0
	Zell a. See	58,0	0	0
St.Michael i. Lungau	192,0	0	0	
<i>Styria</i>	Deutschlandsberg	356,0	0	0
	Gaberl	826,5	0	0
	Graz Platte	1426,0	2,5	0
	Graz West	98,0	0	0
	Graz Schloßberg	375,0	0	0
	Graz Süd	370,5	0	0
	Grundlsee	318,0	0	0
	Hochgössnitz	678,0	0	0
	Judenburg	78,5	0	0
	Leoben	128,0	0	0
	Masenberg	1134,0	0,5	0
	Mürzzuschlag	161,0	0	0
	Piber	747,0	1,0	0
	Rennfeld	1693,5	0,5	0
	Salberg	660,0	0	0
	Stolzalpe	663,5	0	0
	Voitsberg	553,0	0	0
	<i>Tyrol</i>	Gaimberg Zabernig	441,5	0
Innsbruck Andechstraße		119,0	0	0
Karwendel West		1386,0	2,0	0
Kramsach Angerberg		282,0	3,0	0
Kufstein		139,0	3,0	0
Nordkette Seegrube		947,0	0	0
St.Johann i. Tirol		92,0	0	0
Wörgl Stelzhammerstr.		161,0	3,0	0
Zillertaler Alpen		1103,5	0	0

province	station	>110µg/m ³ 8hr average* hours	>180µg/m ³ 1hr average* hours	>360µg/m ³ 1hr average* hours
Vorarlberg	Bludenz Rathaus	164,5	0,5	0
	Lustenau Wiesenrain	230,0	3,0	0
	Sulzberg Gmeind	1099,0	2,5	0
Carinthia	Gerlitz	2055,5	6,5	0
	Klagenfurt-Koschatstr.	292,0	0	0
	Klagenfurt-Kreuzbergl	509,0	1,0	0
	Oberdrauburg	299,0	12,5	0
	Obervellach	152,0	0	0
	Radenthein	160,0	0,5	0
	Spittal a. d. Drau	190,5	0	0
	St.Paul Herzogberg	512,5	0	0
	St.Veit a. d. Glan	32,5	0	0
	Villach	175,0	0	0
	Vorhegg	859,0	5,5	0
Völkermarkt	29,0	0	0	
Wolfsberg-Hauptschule	98,5	0	0	

* running average, interval 30 min

III Analysis

1 Meteorological situation during episodes

Weather 7. - 10. 5. 1992

On May 7. Austria was at the eastern edge of an atlantic high pressure region, but influenced by fringes of cold fronts, that were carried eastward over northern central Europa with fast westerley flow. Cloud cover in Austria was mostly between 4/8 and 6/8, whereas in Carinthia and Styria cloud cover decreased during the day. On May 7 two sites, located in the northwest part of Upper Austria, showed exceedances of the threshold value of $180 \mu\text{g O}_3/\text{m}^3$.

This meteorological situation continued on May 8.; in the morning in the north of Austria there was dense overcast and it rained sometimes; the exceedances of the threshold value of $180 \mu\text{g O}_3/\text{m}^3$ occured in the western part of Carinthia as well as in Hainburg, a town between Vienna and Bratislava, located in Lower Austria at the river Danube.

On May 9. and 10. the influence of cold fronts increased, on May 9. Austria was mostly densely overcast, in the north there were showers in the morning and strong northwest wind, which died down after noon and turned to southwest, in the south of Austria southwest wind freshed up after noon and showers and thunderstorms occured. May 10. also was mostly overcast with relatively strong west wind and frequent showers. At all days valleys and basins in south Austria had fog in the morning. On May 9 and 10 the exceedances of the threshold value occured only in Carinthia.

Daily maximum temperatures in northeast Austria were about 22°C on May 7. and 8., about 18°C on May 9. and 10.; in the south about 20°C on all days. The wide-spread precipitation caused no lasting cooling.

29. 6. - 1. 7. 1992

During these days in Austria there was sunny, high pressure weather. The centre of the high pressure region moved from the North Sea to Eastern Europe. In the west of Austria on June 29. there was larger liability for thunderstorms; except for Tyrol and Vorarlberg, there were few clouds and weak wind. On July 1. a cold front reached west Austria with showers and thunderstorms in total Austria on July 2.

Daily maximum temperatures were between 25 and 27 °C on all days.

On June 30 ozone concentrations higher $180 \mu\text{g}/\text{m}^3$ occurred only at one site in Tyrol (in the western part of Austria at high altitude); on July 1 ozone concentrations higher $180 \mu\text{g}/\text{m}^3$ occurred north of the Alps in the provinces Salzburg, Upper Austria and Lower Austria.

30. 7. - 1. 8. 1992

On July 30 a high pressure region extended over central and eastern Europe. It was sunny, warm and mostly cloudless. Cloud cover was less than 2/8 and wind very weak.

On July 31. a cold front approached from the North Sea, which passed north to Austria on August 1., without altering the weather in Austria; but liability for thunderstorms increased. July 31. was mostly cloudless, but in the evening over whole Austria large convective clouds developed and thunderstorms with showers widely occurred, combined with strong wind.

August 1. was less sunny, cloud cover was between 2/8 and 6/8; in the evening thunderstorms and showers occurred.

Daily maximum temperatures in the northeast lay about 32 °C on July 30 and August 1., and reached 35°C on July 31.

During this ozone episode the highest ozone concentrations not only of the year 1992 but also of the years before occurred on

July 31 (again before a cold front crossed the country). Whereas ozone concentrations above $180 \mu\text{g}/\text{m}^3$ occurred in the area of Upper Austria north of river Danube and some more elevated sites in Lower Austria on July 30, the region with such high ozone concentrations was much larger on the next day, July 31: it included also sites at ground level in Lower Austria, Vienna, parts of Tyrol, Salzburg and Styria as well as parts of Upper Austria south of river Danube.

6. - 10. 8. 1992

Subsequently to a cold front on August 4. there was sunny high pressure weather till August 10.

August 6. was sunny in total Austria, cloud cover was less than 2/8; in the evening mainly in western Austria convective clouds formed. Wind was weak and mainly from the east. In alpine valleys it was foggy. In the subsequent night thunderstorms occurred from Tyrol to Upper Austria. August 7. had cloud covers from 2/8 to 4/8, in the evening in the west and south large convective clouds formed and thunderstorms occurred. August 8. was almost cloudless; the hitherto weak southeast wind freshed up during the day. August 9. was also nearly cloudless, wind speed further increased, mainly in the mountains, with Föhn on the front side of a cold front that reached Austria on August 10.

Daily maximum temperatures in the northeast were about 32°C on August 6., 34°C on August 7., 35°C in August 8. and 9.

Ozone concentrations higher $180 \mu\text{g}/\text{m}^3$ occurred in Vienna and Lower Austria on August 6; on August 7 the region of such high ozone concentrations included some parts of Upper Austria and Salzburg too. On August 8, 9 and 10 the ozone concentrations were lower again and only a few sites (being located in Lower and Upper Austria) still showed concentrations higher $180 \mu\text{g}/\text{m}^3$.

18. - 20. 8. 1992

On August 18. Austria was influenced by a high pressure region over southeast Europe, but south to a weak cold front. On August 19. and 20. the high pressure region expanded and strengthened, but on August 21. a thunderstorm front from the west caused cooling and precipitation.

On August 19. cloud cover was between 1/8 and 2/8, after noon in the west cloud cover increased. In the east the wind was weak from the east, elsewhere there was weak west wind. Daily maximum temperatures were about 35°C.

August 20. was overcast in the north and west in the morning, later on it was sunny with formation of convective clouds. In the north and east there was weak east wind, in the mountains partially strong wind from south to west.

The highest concentrations during this episode again occurred before the crossing of a cold front. On August 18 and 19 only parts of Lower Austria showed ozone concentrations higher 180 $\mu\text{g}/\text{m}^3$, whereas on August 20 parts of Salzburg, Upper Austria and Styria showed such high concentrations too.

26. - 28. 8. 1992

August 24. to 29. were determined by a stable high pressure region, with its centre over central Europa till August 27.; afterwards it weakened, so that over north central Europe westerly flow predominated. The Alps remained under high pressure. From August 30. on subsequent cold fronts induced a severe change in weather conditions.

August 26. was sunny with weak wind, after noon cloud cover increased to 4/8, in the mountains strong northwest to west wind raised, in the Alpenvorland was weak southeast wind. Temperature in Vienna reached 35°C.

August 27. had dense cloud cover in the morning (about 6/8), during the day about 2/8. In the mountains blew strong west to southwest wind, elsewhere wind was very weak. Maximum

temperatures in Vienna reached 34°C.

August 28. was almost cloudless, in the west in the morning with low cloud cover (2/8), in the evening up to 6/8. Wind was strong from southeast both in the mountains as well as in the east and north of Austria. Temperatures in the northeast reached 38°C which were the highest measured in 1992.

On August 26 ozone concentrations higher 180 $\mu\text{g}/\text{m}^3$ occurred only in the surroundings of Vienna and Graz whereas on August 28 such high concentrations occurred in larger parts of Lower Austria as well as in smaller parts of Upper Austria and Styria.

IV Conclusion

The summer 1992 showed that

- o in all parts of Austria the health protection threshold is exceeded; the duration is from 2,5 hours to more than 2000 hours;
- o especially in Lower Austria and Vienna there are frequent exceedances of the population information threshold
- o the data of July 31 showed, that even exceedances of the population warning threshold may occur in Vienna and some parts of Lower Austria under certain meteorological conditions
- o episodes of high ozone concentrations occur mainly on days with temperatures above 30 °C; episodes occur frequently before crossing of a cold front and are due to warm air advection from the south
- o the data show further, that it is necessary to run a rather dense network of ozone monitoring stations to identify all episodes with concentrations higher 180 $\mu\text{g}/\text{m}^3$ throughout Austria.
- o Although episodes of ozone concentrations higher 180 $\mu\text{g}/\text{m}^3$ do occur in small regions too, it is evident that import of precursors as well as of ozone to Austria contributes significantly to such high concentrations.

V Comment

If more detailed information is needed it would be better to provide the raw data on electronic device instead of sending a report.

**Richtlinie 92/72/EWG des Rates vom 21. September 1992
über die Luftverschmutzung durch Ozon**

(ABLEG vom 13. 10. 1992 Nr. L297/1)

Anhang I

Schwellenwerte für die Ozonkonzentrationen in der Luft⁶

(Die Zahlenwerte sind in $\mu\text{g}/\text{O}_3/\text{m}^3$ angegeben. Die Volumenangabe gilt für folgende Temperatur- und Druckwerte: 293 Kelvin, 101,3 KPa.)

1. Schwellenwert für den Gesundheitsschutz
110 $\mu\text{g}/\text{m}^3$ als Mittelwert während acht Stunden⁷.
2. Schwellenwerte für den Schutz der Vegetation
200 $\mu\text{g}/\text{m}^3$ als Mittelwert während einer Stunde,
65 $\mu\text{g}/\text{m}^3$ als Mittelwert während 24 Stunden.
3. Schwellenwert für die Unterrichtung der Bevölkerung
180 $\mu\text{g}/\text{m}^3$ als Mittelwert während einer Stunde.
4. Schwellenwert für die Auslösung des Warnsystems
360 $\mu\text{g}/\text{m}^3$ als Mittelwert während einer Stunde.

6) Die Konzentrationen müssen kontinuierlich gemessen werden.

7) Der Mittelwert über acht Stunden ist gleitend ohne Überlappung; er wird viermal täglich anhand der acht Stundenwerte (0-9 Uhr, 8-17 Uhr, 16-1 Uhr, 12-21 Uhr) berechnet. Was die gemäß Artikel 6 Absatz 1 erster Gedankenstrich zu übermittelnden Angaben betrifft, so ist der Mittelwert über acht Stunden gleitend: Der arithmetische Mittelwert wird berechnet, indem der momentane Stundenwert h mit den vorangehenden sieben einzelnen Stundenwerten gemittelt wird.