

GUIDANCE DOCUMENT VII ON HEALTH AND ENVIRONMENTAL IMPROVEMENTS

Prepared by the Working Group on Effects

I. INTRODUCTION

1. Section II gives the description of the indicators for health and environment used to calculate these indicators for the emissions in 2000 and for the projected baseline emissions in 2020. The improvements for environment and health follow from these two sets of indicators. The calculated improvements on health and environment are somewhat lower than those that would result from using the national projected emission for 2020 resulting from the reduction percentages in annex II, if attained by all Parties by 2020. This Guidance Document describes in section III ecosystem recovery mentioned in article 2 (a) and (b) of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.

II. HEALTH AND ENVIRONMENTAL IMPROVEMENTS

2. The health and environmental improvements for a Party are calculated from the relevant indicators in the year 2000 (Table I.1) and those in 2020 (Table I.2). The formula used to calculate improvements is: $100\% * (\text{Indicator}_{2000} - \text{Indicator}_{2020}) / \text{Indicator}_{2000}$. The values for health and environmental improvements are given in Table I.3. All indicators have been calculated using available data and methodologies according to current state of science. The different indicators are expressed as follows:

Health related to particulate matter (PM) and ground-level ozone exposure:

3. The mortality related to PM exposure is expressed as the statistical loss of life expectancy due to the exposure to anthropogenic PM_{2.5} for persons over 30 years of age. The indicator uses a given age distribution and age-dependent survival rates for each country and does not account for changes in life expectancy over time.

4. The mortality related to exposure to ground-level ozone is expressed as premature mortality. The indicator is based on fixed country mortality rates and is thus independent of variations in baseline mortality with time.

5. The morbidity related to PM and ground-level ozone is an aggregate of respiratory hospital admissions linked to PM and ozone exposure, and cardiac hospital admissions linked to PM exposure, for each country, normalised by national population. The indicator accounts for the change in population over the different years. Air pollution has further 'morbidity' effects that can be quantified in terms of new cases of chronic bronchitis, days of restricted activity and so on. The morbidity indicator provided here is thus a subset of the total morbidity resulting from air pollution.

Acidification:

6. The ecosystem area where the critical load for acidification is exceeded and the average accumulated exceedance (AAE).

Eutrophication:

7. The ecosystem area where the critical load for nutrient nitrogen is exceeded and the average accumulated exceedance (AAE).

Biodiversity:

8. The ecosystem area of (i)(semi-)natural grasslands, (ii)arctic and (sub-)alpine scrub habitats and (iii) understory vegetation of coniferous boreal woodlands (together 53% of European natural area) with a significant change of plant species diversity.

Vegetation related to ground-level ozone exposure:

9. The percentage reduction in wheat yield calculated using the flux based method, presented as the mean per grid square for the squares where wheat is grown and assuming irrigation is used when needed. Wheat is the most extensively grown crop in Europe and is one of the most sensitive European crops to ozone along with soybean, peas and beans. Maize, barley, oilseed rape potato and tomato are moderately sensitive to ozone. Wheat yield loss due to ozone in EU27+CH+NO was estimated to be 14% in 2000 and is predicted to be 9% in 2020. In both years 97% of wheat-growing grid squares are exceeding the critical level.

Materials related to air pollution exposure:

10. The relation of air pollution to materials is expressed for corrosion as the area where the corrosion rate of carbon steel, zinc or limestone exceeds the background corrosion rate by a factor of two. For soiling the relation is expressed as the area where the loss in reflectance of non-transparent materials compared to unsoiled surfaces exceeds 35 per cent in 20 years.

Short-Lived Climate Forcing (SLCF):

11. The SLCF is expressed as the net sum of instantaneous radiative forcing due to short-lived substances in the atmosphere of the EMEP domain.

III. RECOVERY OF ECOSYSTEMS

Acidification

12. Recovery from the adverse effects of acidification can be achieved when the critical load is not exceeded. When recovery is required by a specified year (target year) a deposition value (target load) is required to enable the chemical criterion to attain a non-critical value in the target year. The chemical criterion used for the critical loads calculations is linked to biological effects.

Eutrophication

13. Recovery from the adverse effects of eutrophication may be achieved when the critical load is not exceeded. When recovery is required by a target year, a target load is required to enable the chemical criterion to attain a non-critical value in the target year. The chemical criterion used for critical load calculations is linked to biological effects

Table I.1. Environmental and health indicator values for emissions in 2000

Party	Mortality PM (months)	Mortality Ozone (cases/y)	Morbidity PM and Ozone (cases/y)	Acidification (%)	AAE Acid. (mol H/ha.y)	Eutrophication (%)	AAE Eutro. (mol N/ha.y)	Biodiversity (%)	Wheat yield reduction Ozone (%)	Materials Corrosion (%)	Materials Soiling (%)	SLCF (unit)
Austria	7	438	2694	2	5	100	455	33	16	49	52	
Belgium	13	394	5005	32	624	100	1076	62	18	100	100	
Bulgaria	8	487	2552	0	0	94	250	0	14	84	98	
Cyprus	4	30	118	0	0	66	122	0	19	0	100	
Czech Rep.	9	554	3314	32	326	100	1105	72	20	100	100	
Denmark	7	173	1280	52	473	100	1208	62	9	98	100	
Estonia	5	20	254	0	0	75	104	0	11	1	4	
Finland	3	46	563	3	5	50	63	0	8	0	0	
France	8	2655	21286	13	65	98	622	10	16	55	91	
Germany	10	4324	32736	61	475	86	681	72	19	99	98	
Greece	8	604	4236	4	18	100	292	0	18	25	98	
Hungary	10	749	3837	32	246	100	588	4	14	100	100	
Ireland	4	64	523	26	139	91	726	3	6	86	100	
Italy	8	4787	23163	0	0	71	397	38	23	66	94	
Latvia	5	49	466	20	50	100	293	0	10	12	11	
Lithuania	6	78	642	34	234	100	523	1	12	26	79	
Luxembourg	10	31	132	15	182	100	1178	18	20	100	100	
Malta	6	24	85						22	100	100	
Netherlands	12	418	6950	84	2432	95	1570	87	11	100	100	
Poland	9	1415	12584	82	894	100	790	59	16	100	100	
Portugal	8	495	3695	11	87	97	214	0	13	32	84	
Romania	9	1073	7486	55	292	23	29	0	12	90	100	
Slovakia	9	242	1527	25	137	100	703	48	16	100	100	
Slovenia	8	110	1719	8	43	99	430	43	23	98	100	
Spain	5	1915	9877	4	27	95	351	6	13	16	38	
Sweden	3	176	1767	17	27	59	151	1	8	8	6	

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United Kingdom	7	1353	16839	44	350	28	185	6	8	89	87	
EU27	8		165330	20	138	75	362	16	14	55	70	
Albania	6	109	523	0	0	100	317	0		80	96	
Armenia			231							0	0	
Azerbaijan			391							0	0	
Belarus	7	269	1723	19	63	100	415	0		15	88	
Bosnia-H	6	197	789	13	49	89	287	0		38	92	
Croatia	8	305	1367	4	30	100	569	5		71	100	
FYR Macedonia	6	90	370	13	30	100	330	0		27	100	
Georgia			335							0	0	
Kazakhstan										0	0	
Montenegro			92							2	32	
R Moldova	7	147	849	1	1	96	345	0		44	100	
Norway	2	68	536	17	52	24	36	1	1	4	3	
Russian Fed.	9	3900	22151	1	2	31	37	0		3	14	
Serbia+Montenegro	8	455	2191	19	65	97	311	0				
Serbia			2099							67	98	
Switzerland	6	395	2243	10	49	99	716	48	10	29	51	
Turkey		1617	7751							7	18	
Ukraine	9	2189	11134	9	26	100	544	0		53	100	
Iceland			3									
Kyrgyzstan												
Non-EU	8	9742	52679							11	26	
Total	8	32449	218009	12	69	54	202	10	14	28	44	

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Table I.2. Environmental and health indicators values for the year 2020

Party	Mortality PM (months)	Mortality Ozone (cases/y)	Morbidity PM and Ozone (cases/y)	Acidification (%)	AAE Acid. (mol H/ha.y)	Eutrophication (%)	AAE Eutro. (mol N/ha.y)	Biodiversity (%)	Wheat yield reduction Ozone (%)	Materials Corrosion (%)	Materials Soiling (%)	SLCF (unit)
Austria	4	284	1502	0	0	73	133	3	9	3	0	
Belgium	7	341	2893	15	108	85	410	39	14	80	80	
Bulgaria	4	373	1269	0	0	59	62	0	10	5	5	
Cyprus	4	26	130	0	0	66	124	0	17	0	100	
Czech Rep.	5	372	1966	18	75	100	652	12	11	43	1	
Denmark	4	151	816	7	15	100	603	44	6	1	39	
Estonia	3	18	127	0	0	31	25	0	7	0	0	
Finland	2	46	437	1	1	26	18	0	5	0	0	
France	4	1859	12009	3	9	87	277	1	10	7	20	
Germany	5	3013	18630	19	62	62	278	38	11	43	16	
Greece	4	506	2622	0	0	98	187	0	13	3	12	
Hungary	5	516	2010	4	6	99	304	0	9	11	2	
Ireland	2	80	395	6	12	79	386	0	4	4	55	
Italy	4	3408	13178	0	0	50	164	20	16	20	9	
Latvia	4	42	310	3	4	92	148	0	6	0	0	
Lithuania	4	62	399	30	79	100	376	0	7	0	0	
Luxembourg	5	23	86	12	38	99	667	15	13	53	53	
Malta	4	20	92						17	100	100	
Netherlands	6	339	4128	75	1043	86	891	56	9	100	100	
Poland	5	1017	7687	37	159	98	490	4	9	79	4	
Portugal	3	452	1924	3	7	66	62	0	10	14	32	
Romania	5	798	4351	4	2	2	1	0	8	8	7	
Slovakia	5	165	876	7	10	100	372	0	9	27	0	
Slovenia	4	75	1019	0	0	63	74	0	15	11	0	
Spain	2	1545	6025	0	0	89	190	0	10	5	7	
Sweden	2	160	1098	4	2	36	60	0	5	0	0	

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United Kingdom	3	1681	9740	14	37	17	52	1	6	51	37	
EU27	4	17374	95719	6	20	59	169	5	9	19	13	
Albania		92	301	0	0	98	229	0				
Armenia			197									
Azerbaijan	3		416							2	0	
Belarus		222	1201	7	7	97	303	0		0	0	
Bosnia-H		151	554	0	0	72	130	0		0	0	
Croatia	5	221	767	2	2	99	309	0		1	0	
FYR Macedonia	3	75	227	0	0	100	185	0		0	0	
Georgia	4		252							0	0	
Kazakhstan	3									4	0	
Montenegro			41							0	0	
R Moldova		128	611	0	0	92	226	0		0	0	
Norway		81	363	7	10	9	6	0	1	0	0	
Russian Fed.	5	3859	19181	1	1	11	12	0		1	2	
Serbia+Montenegro	1	350	1032	0	0	78	135	0				
Serbia			991							0	0	
Switzerland	9	250	1305	4	14	96	409	19	6	1	4	
Turkey	4	1631	8322							5	5	
Ukraine	3	1892	7610	1	2	100	341	0		4	0	
										4	5	
Iceland			3									
Kyrgyzstan												
Non-EU	7	8953	42342							3	5	
Total	5	26327	138061	4	10	37	96	3	9	10	8	

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Table I.3. Relative environmental and health improvements in 2020 (Table I.2) compared to the year 2000 (Table I.1)

Party	Mortality PM (%)	Mortality Ozone (%)	Morbidity PM and Ozone (%)	Acidification ¹ (%)	AAE Acid. (%)	Eutrophication (%)	AAE Eutro. (%)	Biodiversity ¹ (%)	Wheat yield reduction Ozone (%)	Materials Corrosion ² (%)	Materials Soiling ² (%)	SLCF (unit)
Austria	51	35	49	100	100	2	71	91	44	95	100	
Belgium	48	13	48	53	83	15	62	37	24	20	20	
Bulgaria	51	23	44	n/a	n/a	37	75	n/a	0	28	95	
Cyprus	18	13	15	n/a	n/a	0	-1	n/a	13	N/A	N/A	
Czech Rep.	49	33	44	44	77	0	41	83	46	57	99	
Denmark	46	13	41	87	97	0	50	29	37	99	61	
Estonia	37	10	50	n/a	100	59	76	n/a	37	100	100	
Finland	30	0	29	67	85	48	72	n/a	34	0	0	
France	53	30	50	77	86	11	56	90	36	87	78	
Germany	49	30	44	69	87	28	59	47	39	56	84	
Greece	50	16	43	100	99	2	36	n/a	26	89	88	
Hungary	49	31	46	88	97	1	48	100	40	89	98	
Ireland	47	-25	43	77	92	13	47	100	28	96	45	
Italy	50	29	49	n/a	n/a	30	59	47	31	70	90	
Latvia	25	14	28	85	93	8	49	n/a	39	100	100	
Lithuania	34	21	33	12	66	0	28	100	39	100	100	
Luxembourg	51	26	51	20	79	1	43	17	33	47	47	
Malta	27	17	2						25	0	0	
Netherlands	48	19	46	11	57	9	43	36	20	0	0	
Poland	44	28	40	55	82	2	38	93	42	21	96	
Portugal	57	9	51	73	92	32	71	n/a	21	58	61	
Romania	44	26	40	93	99	91	97	n/a	32	91	93	
Slovakia	50	32	45	72	93	0	47	100	44	73	100	
Slovenia	50	32	45	100	100	36	83	100	37	89	100	
Spain	51	19	50	100	99	6	46	100	28	68	81	
Sweden	42	9	45	76	92	39	61	100	37	99	100	

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United Kingdom	50	-24	49	70	89	39	72	83	27	42	57	
EU27	49	23	47	70	86	21	53	69	32	66	82	
Albania	50	16	47	n/a	n/a	2	28	n/a		98	100	
Armenia			19							N/A	N/A	
Azerbaijan			17							N/A	N/A	
Belarus	26	17	26	63	89	3	27	n/a		95	100	
Bosnia-H	53	23	31	100	100	19	55	n/a		100	100	
Croatia	48	28	43	50	92	1	46	100		100	100	
FYR Macedonia	56	17	41	100	100	0	44	n/a		86	100	
Georgia			15							N/A	N/A	
Kazakhstan										N/A	N/A	
Montenegro			56							100	100	
R Moldova	33	13	13	100	100	4	35	n/a		100	100	
Norway	46	-19	42	59	81	63	82	100	46	84	42	
Russian Fed.	2	1	11	0	56	65	68	n/a		54	73	
Serbia+Montenegro	53	23	50	100	100	20	57	n/a				
Serbia			52							93	95	
Switzerland	52	37	48	60	71	3	43	60	46	85	100	
Turkey	N/A	-1	16							42	74	
Ukraine	21	14	24	89	94	0	37	n/a		60	72	
Iceland			22									
Kyrgyzstan												
Non-EU	13	8	22							69	80	
Total	38	19	40	67	85	31	53	70	33	66	81	

¹For some countries there is no exceedance in 2000 and 2020. In these cases n/a (not applicable) appears for these countries.

²For some countries the 2000 and 2020 data were (very) limited. In these cases N/A (Not Assessed) appears for these countries.