Adjustment DE-A - NOx from 1.A.3.b Road transport

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During the adjustment review 2014, additional data and information has been implemented as sections STEP 5 and 5.1 of this report!
In addition, new results have been included in the RESULTS & CONCLUSIONS section at the end of this adjustment report.
Any new or revised content has been tagged as followes:
NEW OR REVISED TEXT & DATA > New content... **< NEW OR REVISED TEXT & DATA)**

PREFACE

When deriving proposals for national emission ceilings for negotiations of the 1999 Gothenburg Protocol, sector-specific emission estimates for the year 2010 were calculated at IIASA using a set of scenarios which assumed various technological abatement measures, policy incentives, and legislation available / in place or planned at that time. As a result, the 2010 emission by road transport in Germany was estimated at NO_x (IIASA 1999) [4]. The over-all 2010 national emission ceiling (NEC) for NO_x was set to 1,081 kt. When negotiating the EU NEC Directive two years later, Germany agreed to reduce its NO_x emissions further, resulting in a NEC of 1,051 kt.

In its 2013 NEC emissions reporting, Germany provided a national total for NO_x emissions of 1,325 kt for 2010. However, this total includes emissions from agricultural soils and other source categories not accounted for when setting the NEC. In addition, some assumptions made in 1999, including on emission factors from road traffic, turned out to be wrong in reality. Like in many other European countries, non-compliance with the 2010 NEC as set in 1999 was partly not caused by failed national mitigation policies, but by changes beyond the control of, and unforeseen by, the individual Party or Member State.

In order to differentiate such changes from policy failures in the responsibility of the individual Parties to the Gothenburg Protocol, a procedure (Inventory Adjustment) allowing the adjustment of emissions resulting from new emission categories, changes in estimation methodologies, emission factors etc. provided within the EMEP/EEA Guidebook, or other effects beyond national control with respect to complying to emission reduction obligations (EB 2012a, 2012c) [1], [3] was agreed. This procedure is applicable also for existing NECs (EB

2012b) [2].
With respect to road transport, such an unforeseeable effect was the partial failure of several so-called “Euro norms” set on the EU level to reduce emissions from road vehicles.
In this report, Germany presents an estimate of the NO_x emissions resulting from the partial failure of the mitigation policy reflected by the Euro norms, and lays out the calculations leading to these estimates.

ADJUSTMENT PROPOSAL

INITIAL ASSUMPTION

In order to estimate the effect of NO_x emissions resulting from the failure of the so-called Euro norms, it is vital to define a range of 2010 emission levels within which the final adjustment shall take place.
This range is determined by the sector-specific emission estimated in 1999 and the sector-specific emissions provided within the 2013 reporting. Here, the latter value can be taken directly from the annual NEC and CLRTAP submission, providing an aggregate amount of NO_x emissions from road transport of 507.8 kt for 2010. The former value has already been referenced above and amounts to 417.8 kt.

2010 sectoral NO_x emissions (including abatement) from German road transport (IIASA 1999) [4]	417.8 kt
2010 sector-total for NO_x from German road transport from (UBA 2013a) [8]	507.8 kt
absolute difference	90 kt

However, this difference is not the emission to which inventory adjustment is applicable. Instead, only the difference which can be attributed to the use of improper emission factors deduced from the Euro-norms has to be determined.

Within this report, Germany re-estimates the NO_x emission within the TREMOD 3.1 model (ifeu, 2002) [5]. To isolate the requested information, several estimations were carried out within this model combining original 1999 RAINS activity data (IIASA 1999) [4] with emission factors from both TREMOD 3.1 and the currently used TREMOD 5.4 (ifeu, 2013) [6].

STEP 1 – REPRODUCING THE RAINS SECTORIAL EMISSION ESTIMATE

It is the aim of this initial step to reproduce the sectorial emission of **417.8 kt** which were taken into account in 1999 as the this sector's specific share of the over-all emission ceiling set for 2010. Therefore it was tried to reproduce this sectorial value estimated within RAINS in 1999 within TREMOD 3.1, the oldest TREMOD version still available.

This comparative calculation resulted in **402.5 kt of NO_x** for 2010. Compared to the 417.8 kt provided in (IIASA 1999) [4], a **difference of 15.3 kt NO_x** occurs, that can be ascribed to the necessary aggregation and different methodologies used in RAINS and TREMOD. For the purpose of the calculations described in this report, the match is certainly "good enough", since only relative shares rather than the actual values will be used below.

RESULT: effect (c) = 15.3 kt NO_x (see STEP 4 below)

STEP 2 – ISOLATING THE CONTRIBUTION OF CHANGED EMISSION FACTORS

For this step, activity data from the oldest TREMOD Version still available, TREMOD 3.1 ware combined with current emission factors taken from TREMOD 5.4.

For this, data had to be prepared as follows:

- (i) Estimation of average emission factors (EF) per vehicle category, type of impulsion (diesel, gasoline) and emission concept (conventional or Euro-norm) from both TREMOD versions for 2010
- (ii) Deduction of the change in emissions compared to a conventional vehicle for Euro-1 to -5 of for every vehicle category in TREMOD 5.4: As a result, correction factors ($CF_{5.4}$) are deduced for all Euro-norms (1 to 5) compared to a conventional vehicle.
- (iii) Transfer of these $CF_{5.4}$ to TREMOD 3.1, resulting in corrected emission factors ($EF_{3.1,\ corr.}$) within this model
- (iv) Re-estimation of 2010 NO_x emissions in TREMOD 3.1 using these corrected emission factors.

The following table shows the approach for three selected vehicle categories ((a) Diesel Passenger (Cars D-PC), (b) Gasoline Passenger Cars (G-PC) and (c) Articulated Trucks (AT, diesel only)).

Table 1: Re-estimation of 2010 NO_x emissions in scenario TREMOD 3.1, using current knowledge on the development of EF(NO_x) per

Euro-level – for diesel and gasoline PC and articulated trucks

	$EF_{3.1}$	$EF_{5.4}$	$CF_{3.1}$	$CF_{5.4}$	$EF_{3.1, corr.}$	$Mileage_{3.1}$	EM_{old}	EM_{new}
	[g/km]		[1]		[g/km]	[10^9 km]	[kt]	
Diesel Passenger Cars (D-PC)								
Conventional	0.67	0.81	1.00	1.00	0.67	0.0	0.0	0.0
Euro-1	0.67	0.75	1.00	0.92	0.62	2.9	1.9	1.8
Euro-2	0.49	0.79	0.74	0.98	0.66	9.3	4.6	6.1
Euro-3	0.36	0.83	0.54	1.03	0.68	48.8	17.7	33.4
Euro-4	0.24	0.53	0.37	0.66	0.44	123.7	30.2	54.4
Euro-5	0.24	0.53	0.37	0.65	0.43	30.7	7.5	13.3
D-PC TOTAL						**215.3**	**61.9**	**109.0**
Gasoline Passenger Cars (G-PC)								
conventional	1.33	1.41	1.00	1.00	1.33	0.2	0.3	0.3
pre Euro-1	0.68	0.95	0.51	0.67	0.90	1.0	0.7	0.9
Euro-1	0.66	0.95	0.50	0.67	0.90	9.5	6.3	8.5
Euro-2	0.38	0.47	0.28	0.33	0.44	17.8	6.7	7.9
Euro-3	0.19	0.09	0.14	0.06	0.08	49.3	9.4	4.2
Euro-4	0.10	0.10	0.07	0.07	0.09	303.6	29.6	27.8
G-PC TOTAL						**381.5**	**53.0**	**49.6**
Articulated Truck (AT)								
conventional	12.48	11.38	1.00	1.00	12.48	0.1	0.8	0.8
Euro-I	9.16	8.11	0.73	0.71	8.89	0.1	0.8	0.8

Euro-II	8.27	8.94	0.66	0.79	9.81	1.6	13.3	15.8
Euro-III	5.61	6.70	0.45	0.59	7.35	7.4	41.6	54.5
Euro-IV	4.29	3.59	0.34	0.32	3.94	4.8	20.8	19.1
Euro-V	2.15	2.30	0.17	0.20	2.52	9.4	20.1	23.6
AT TOTAL						**23.4**	**97.5**	**114.6**

Source:Estimations carried out at ifeu Institute, Heidelberg, by Wolfram Knörr (ifeu 2014) [7]

EF = emission factor
CF = correction factor
$_{3.1}$ = data from TREMOD 3.1 (ifeu 2002) [5]
$_{5.4}$ = data from TREMOD 5.4 (ifeu 2013) [6]
$_{corr.}$ = corrected using CF

Combining the vehicle categories as provided in RAINS (light gasoline vehicles (LGV), light diesel vehicles (LDV), and heavy diesel vehicles (HDV)) results in the following emission estimates for original and current EF:

Table 2: Re-estimation of 2010 NO_x emissions using RAINS vehicle categories – based on mileage

	EM_{old}	**EM_{new}**	**Difference**	
	[kt]			[%]
LGV	58.9	55.4	-3.5	-6
LDV	76.9	133.0	+56.1	+73
HDV	248.4	303.9	+55.5	+22
TOTAL	**384.2**	**492.3**	**+108.1**	**+28**

Source: Estimations carried out at ifeu [7]

Here, the mileage-based emission estimation using current EF results in 492.3 kt NO_x emissions for 2010.

As the emission estimates for emissions reporting are not based on mileage (as in TREMOD) but on fuel consumption data from the National Energy Balance, a correction of the mileage-based EF to energy-based EF is necessary (UBA 2013b) [9]. Using these energy-based EFs results in the following estimates:

Table 3: Re-estimation of 2010 NO_x emissions using RAINS vehicle categories – based on fuel consumption

	EM_{old}	**EM_{new}**	**Difference**	
	[kt]			[%]
LGV	61.2	57.4	-3.8	-6
LDV	89.5	155.3	+65.8	+73
HDV	251.8	307.9	+56.1	+22
TOTAL	**402.5**	**520.7**	**+118.2**	**+29**

Source: Estimations carried out at ifeu [7]

Re-estimating NO_x emissions from road transport in TREMOD 3.1 using current energy-based EF results in **520.7 kt of NO_x**. Compared to the 417.8 kt from [IIASA 1999] this means an **additional amount of 118.2 kt NO_x**.

> **RESULT: effect (a) = 118.2 kt NO_x** (see STEP 4 below)

Since the amount of 2010 NO_x emissions calculated here is higher than the amount provided in the 2013 NEC submission **(507.8 kt)**, there have to be other, even antagonistic, effects that lead to a stronger decrease of emissions reported within the inventory (see STEP 3).

> **$507.8\ kt\ NO_{x,\ 2013\ Submission} - 402.5\ kt\ NO_x = 105.3\ kt\ NO_x = 118.2\ kt\ NO_x - X\ kt\ NO_{x,\ additional\ effects}$**

STEP 3 – EXCLUSION OF THE CONTRIBUTION OF CHANGED ACTIVITY DATA (MILEAGE)

Within this step, original RAINS activity data was combined with current emission factors and mileage data from TREMOD 5.4.

Table 4: Comparison of TREMOD 3.1 and TREMOD 5.4 mileage estimates for 2010, in [10^9 km]

	Mileage as estimated in		**Relative difference**
	TREMOD 3.1	TREMOD 5.4	
Light gasoline vehicles	405.3	361.6	-11%
Light diesel vehicles	247.8	278.3	+12%
Heavy diesel vehicles	69.3	60.0	-13%
2010 mileage TOTAL	**722.4**	**700.0**	**-3%**

Source: Estimations carried out at ifeu [7]

In detail, mileage for gasoline cars and HDV was 11 and 13 per cent lower than assumed whereas mileage of light diesel cars was 12 per cent higher (see Table 4). Driven mostly by the LGV, the over-all mileage 2010 is about 3 per cent lower than originally projected.

As shown above, the actual 2010 over-all mileage (700 bn. km) is slightly smaller than expected in 1999 (722 bn. km), resulting in emissions of 492.4 kt NO_x. Compared to the emissions estimated using current EF only (STEP 2: 520.7 kt) this leads to a **reduction of 28.3 kt**.

Table 5: Comparison of NO_x emission estimates for 2010, in [kt]

	NO_x emissions as estimated in TREMOD 3.1 using...		
	...original EF	**...current EF**	**...current EF+ mileage**
Light gasoline vehicles	61.2	57.4	51.2
Light diesel vehicles	89.5	155.3	174.4
Heavy diesel vehicles	251.8	307.9	266.7
TOTAL RT emissions	**402.5**	**520.7**	**492.4**

Source: Estimations carried out at ifeu [7]

The actual development of over-all mileage and, hence, fuel consumption led to lower NO_x emissions (minus 28.3 kt) than originally assumed. Therefore, the adjustable amount needs to be relatively increased to compensate this antagonistic mileage-effect (see STEP 4).

RESULT: effect (b) = -28.3 kt NO_x (see STEP 4 below)

STEP 4 – DEDUCING THE ADJUSTABLE AMOUNT OF NO_x EMISSIONS

As shown above, possible lower borders for defining a possible range of adjustment could be set at 402.5 kt (as deduced in STEP 1) or 417.8 kt NO_x (IIASA 1999)

Possible upper borders could be set at 508 kt (inventory 2013) or 520.7 kt (as deduced in STEP 2).

Resulting from these upper and lower borders, the following possible ranges of adjustment can be defined:

Table 6: Overview of deduced lower and upper emission borders and resulting ranges

	lower border	**upper border**	**resulting range**
	[kt NO_x]		
(i)	402.5	520.7	R_1 = 118.2
(ii)	402.5	507.8	R_2 = 105.5
(iii)	417.8	520.7	R_3 = 102.9
(iv)	417.8	507.8	R_4 = 90.2

Following the Guidelines on Adjustments [10], Germany decided to use the 1999 IIASA value (**417.8 kt**) as the *lower border* of the possible adjustment-range. This decision results in a conservative, reduced adjustment range. For the *upper border* we propose **507.8 kt** (2013 NEC inventory) of 2010 NO_x emissions, which again reduces the possible adjustment range.

Table 7: Crosstabulation - Comparison of NO_x emissions resulting from the different combinations of AD and EF described above

AD from	**RAINS**	**TREMOD 3.1**	**TREMOD 5.4**
EF from			
RAINS	**417.8 kt**		
TREMOD 3.1		*402.5 kt*	
TREMOD 5.4		*520.7 kt*	**507.8 kt**

These set borders give a difference of **90.2 kt NO_x (R_4)** resulting from the combined impact of three (partly antagonistic) effects. **In order to deduce the *final adjustable amount*, any additional effects have to eliminated!:**

- (a) Updated emission factors as a result of the failed EURO-Norms

$$= +118.2kt \quad (1)$$

- (b) Lower over-all activity data 2010 than anticipated in 1999 (see Step 3 above)

$$= -28.3kt \quad (2)$$

and

- (c) Other effects such as methodological differences between RAINS (1999), TREMOD 3.1 and 5.4 (Differences in vehicle layers, fleet composition etc.) and effects resulting from the necessary aggregation of detailed TREMOD to allow the combination with the more aggregate 1999 RAINS AD

$$= 417.8kt - 402.5kt = +15.3kt \quad (3)$$

No further information e.g. on emission factors is available regarding the 417.8 kt of NO_x determined within RAINS in 1999, and reproducing 1999 estimates as described in this report was carried out in TREMOD 3.1.

Therefore, defining the contribution of Euro-norm failure to range R_4 has to start with analysing Range R_2 defined by a lower border as estimated in STEP 1 (TREMOD 3.1 + RAINS AD: 402.5 kt) and the 2013 NEC submission (TREMOD 5.4: 507.8 kt). This range (R_2 = 105.5 kt) includes all three effects listed above.

As shown in the Steps 1 to 4, the effects amounting to 105.5 kt (R_2) can be accounted for as follows:

$$118.2kt - 28.3kt + 15.3kt = 105.5kt \tag{4}$$

To isolate the contribution of the Euro-norms failure (share A) in the possible adjustment range, its relative contribution has to be applied to the 90.2 kt defined above.
In order to do this, the known shares (B), and (C) have to be multiplied by $f_{corr.}$ = 90.2 kt/105.5 kt ≈ 0.855:

$$R_4 = (A) + (B) \cdot f_{\text{corr.}} + C \cdot f_{\text{corr.}} \tag{5}$$

Inserting the amounts deduced in STEPs 1 and 3 above gives:

$$\begin{gathered} 90.2kt = (A) + (-28.3kt) \cdot f_{\text{corr.}} + (15.3kt) \cdot f_{\text{corr.}} \\ 90.2kt = (A) + (-24.20kt) + 13.08kt \\ 77.1kt = (A) + (-24.20kt) = (A) - 24.20kt \\ 101.3kt = (A) \end{gathered} \tag{6}$$

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These **101.3 kt of addtional NO_x** represents the amount that results entirely from changes in emission factors due to Euro-norm failure. Compared to Range 4 (R_4) defined above with **90.2 kt NO_x**, the contributions of both metodological differences between RAINS (1999), TREMOD 3.1 and TREMOD 5.4, and of the lower over-all activity data 2010 (than anticipated in 1999) are eliminated.

Firstly, the named **methodological differences** (see STEP 1) result in slightly higher 2010 emissions than the pure application of current EF to the old model would suggest. Therefore, to compensate this effect and to define the pure contribution of emission factors, the predefined adjustment range R_4 had to be relatively decreased.

Secondly, the named **lower over-all activity data 2010** (than anticipated in 1999; see STEP 3) results in slightly lower 2010 emissions than the pure application of current EF to the old model would suggest. Therefore, to compensate this effect and to define the pure contribution of emission factors, the predefined adjustment range R_4 had to be relatively increased.

Taking into account all contributing effects, the final range of adjustment $R_{4,\ clean}$ is 101.3 kt of additional NO_x resulting from Euro-norm failure only.

STEP 5 - DEDUCING THE ADJUSTMENT PROPOSALS FOR 2011 & 2012

As the original GAINS data is only representative for estimating the adjustment proposal for 2010, no such approach can be applied properly for 2011 and 2012. Therefore, adjustment proposals for (2009,) 2011 and 2012 were derived from the ratio of the official values reported for these years and 2010 with the 2014 CLRTAP submission.

Table 8: Deduction of ratios (based on data from 2014 CLRTAP submission!)

	2009	**2010**	**2011**	**2012**
1.A.3.b Total	529.62	508.23	480.27	460.01
ratios against 2010	+4.21 %	-	-5.50 %	-9.49 %

The adjustment proposals were then calculated by applying these ratios to the 2010 adjustment estimate (101.30 kt NO_x).

Table 9: Deduction of the adjustment proposals (based on data from 2014 CLRTAP submission!)

	2009	**2010**	**2011**	**2012**
adjustment proposal estimate	-	101.30 kt	-	-
derived adjustment proposal	**-105.56 kt**	-	-95.73 kt	-91.69 kt

resulting adjusted emissions	**412.50 kt**	406.93 kt	384.54 kt	364.28 kt

STEP 5.1 - DEDUCING THE ADJUSTMENT PROPOSALS FOR PROJECTION YEARS 2015, 2020, AND 2030

The adjustment proposals for the three projection years were derived as described for 2011 and 2012.

Table 10: Deduction of ratios (based on data from 2014 CLRTAP submission!)

	2010	**2015**	**2020**	**2030**
1.A.3.b Total	508.23 kt	408.56 kt	262.28 kt	169.82 kt
ratios against 2010	-	-19.61 %	-48.39 %	-66.59 %

The adjustment proposals were then calculated by applying these ratios to the 2010 adjustment estimate (101.30 kt NO_x).

Table 11: Deduction of the adjustment proposals (based on data from 2014 CLRTAP submission!)

	2010	**2015**	**2020**	**2030**
adjustment proposal estimate	101.30 kt	-	-	-
derived adjustment proposal	-	-81.43 kt	-52.28 kt	-33.85 kt
resulting adjusted emissions	406.93 kt	312.83 kt	166.56 kt	74.09 kt

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RESULTS & CONCLUSIONS

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The amount of **additional NO_x** emitted in **2010** due to the failure of Euro-norms (= adjustment proposal 2010) is **101.3 kt**.

For the years **2011** and **2012**, Germany furthermore derives adjustment proposals of **95.73** and **91.69 kt** respectively.

In addition, for the projection years **2015**, **2020** and **2030**, possible adjustments would amount to **81.43**, **52.28** and **33.85 kt**.

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Bibliography

1. EB 2012a: CLRTAP EB Decision 2012/3, ECE/EB.AIR/111/Add.1: Adjustments under the Gothenburg Protocol to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them
URL: http://www.unece.org/fileadmin/DAM/env/documents/2013/air/ECE_EB.AIR_111_Add.1__ENG_DECISION_3.pdf
2. EB 2012b: CLRTAP EB Decision 2012/4: Provisional Application of Amendment to the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone
URL: http://www.unece.org/fileadmin/DAM/env/documents/2013/air/ECE_EB.AIR_111_Add.1__ENG_DECISION_4.pdf
3. EB 2012c: CLRTAP EB Decision 2012/12: Guidance for adjustments under the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them
URL: http://www.unece.org/fileadmin/DAM/env/documents/2012/EB/Decision_2012_12.pdf
4. IIASA 1999: Amann, M.; Bertok, I.; Cofala, J.; Gyarfas, F.; Heyes, Chr.; Klimont, Zb.; Syri, S.; Schöpp, W.: Further analysis of scenario results obtained with the RAINS model - Interim Report to the Ministère de L'Aménagement du Territoire et de l'Environment Direction de la Prévention des Pollutions et des Risques 20, avenue de Ségur75302 Paris 07 SP, April 1999 – URL: http://www.iiasa.ac.at/~rains/reports/french-may.pdf
5. ifeu 2002: Final report to UFOPLAN study FKZ 201 45 112 (German version only): Aktualisierung des Daten- und Rechenmodells: Energieverbrauch und Schadstoffemissionen des motorisierten Verkehrs in Deutschland 1980-2020; Im Auftrag des Umweltbundesamtes; ifeu Institut für Energie- und Umweltforschung Heidelberg GmbH (Institute for Energy and Environmental Research), Wilckensstraße 3, D-69120 Heidelberg, Germany, phone: +49 (0) 6221 / 47 67 -0, fax: +49 (0) 6221 / 47 67 -19, Heidelberg, 31. Oktober 2002
6. ifeu 2013: Knörr, W.; Bergk, F.; Gores, S. (Öko-Institut); Heidt, Chr.: Final report (German version only): Aktualisierung Daten- und Rechenmodell: Energieverbrauch und Schadstoffemissionen des motorisierten Verkehrs in Deutschland 1960-2030 (TREMOD) für die Emissionsberichterstattung 2014 (Berichtsperiode 1990-2012), Im Auftrag des Umweltbundesamtes, ifeu Institut für Energie- und Umweltforschung Heidelberg GmbH (Institute for Energy and Environmental Research), Wilckensstraße 3, D-69120 Heidelberg, Germany, phone: +49 (0) 6221 / 47 67 -0, fax: +49 (0) 6221 / 47 67 -19, Heidelberg, 30.11.2013
7. ifeu 2014: data derived from personal communication with Wolfram Knörr, ifeu Institut für Energie- und Umweltforschung Heidelberg

GmbH (Institute for Energy and Environmental Research), Wilckensstraße 3, D-69120 Heidelberg, Germany, phone: +49 (0) 6221 / 47 67 -0, fax: +49 (0) 6221 / 47 67 -19, Heidelberg, January 2014
8. UBA 2013a: German submission 2013 under the Convention on Long-Range Transboundary Air Pollution (CLRTAP); Centre on Emission Inventories and Projections (CEIP) URL: http://webdab1.umweltbundesamt.at/download/submissions2013/DE_NFR2013.zip?cgiproxy_skip=1
9. UBA 2013b: German Informative Inventory Report 2013 to the 2013 submission under the Convention on Long-Range Transboundary Air Pollution (CLRTAP); Federal Environment Agency (UBA), 2013 - URL: http://iir-de.wikidot.com/road-transport
10. ECE/EB.AIR/113/Add.1 2012: Report of the Executive Body on its thirty-first session, Decision 2012/12 on Guidance for adjustments under the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them; URL: http://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_113_Add.1_ENG_1_.pdf

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