For our Environment

Umwelt Bundesamt

TFIAM, Tallinn, 28-29 June 2018

National support to improve air quality?

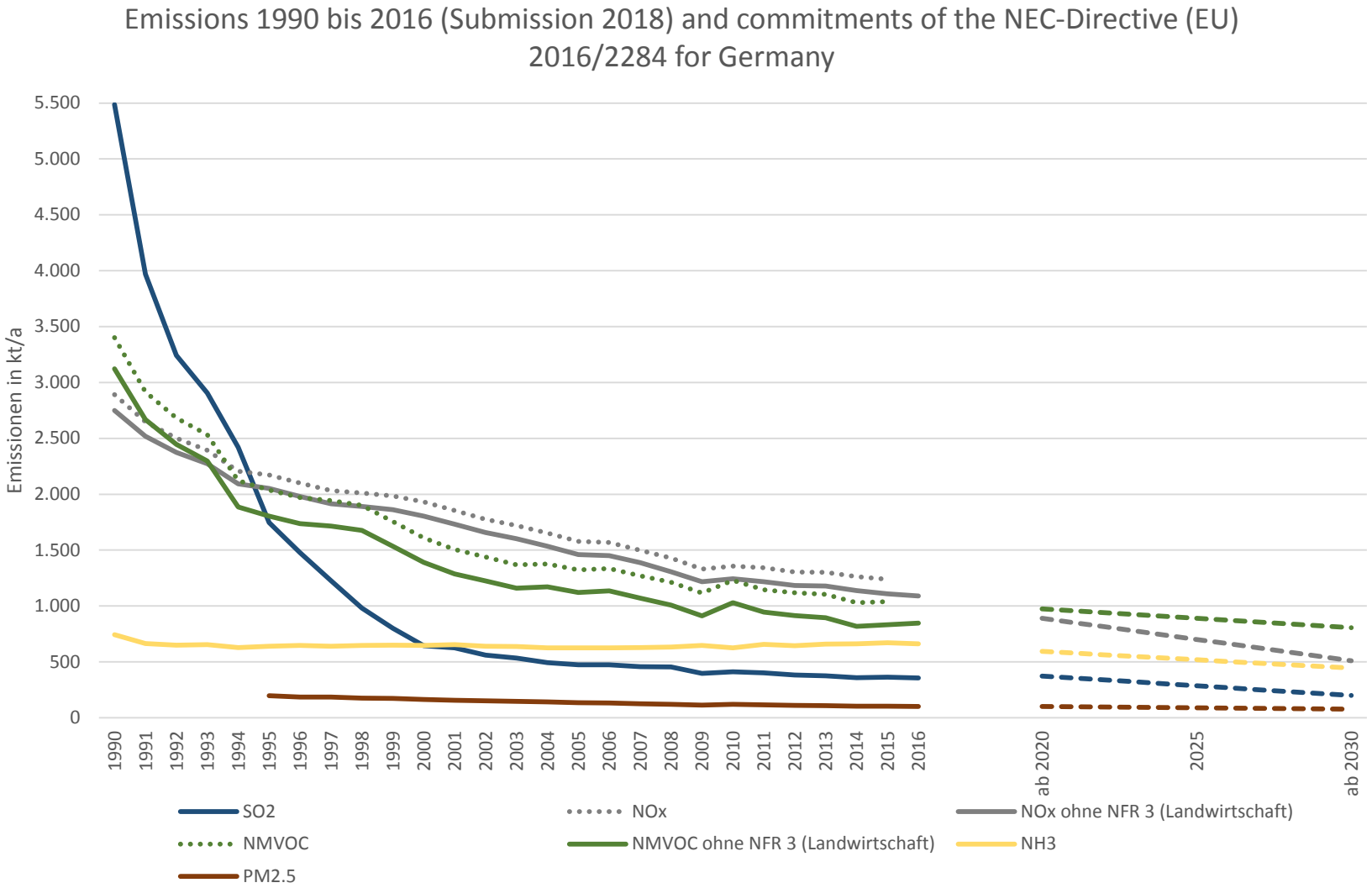
Andreas Eisold
Section II 4.1 / General Aspects of Air Quality Control

with support from Marcel Langner, Johanna Appelhans, Kevin Hausmann, Stefan Feigenspan, Stephan Nordmann

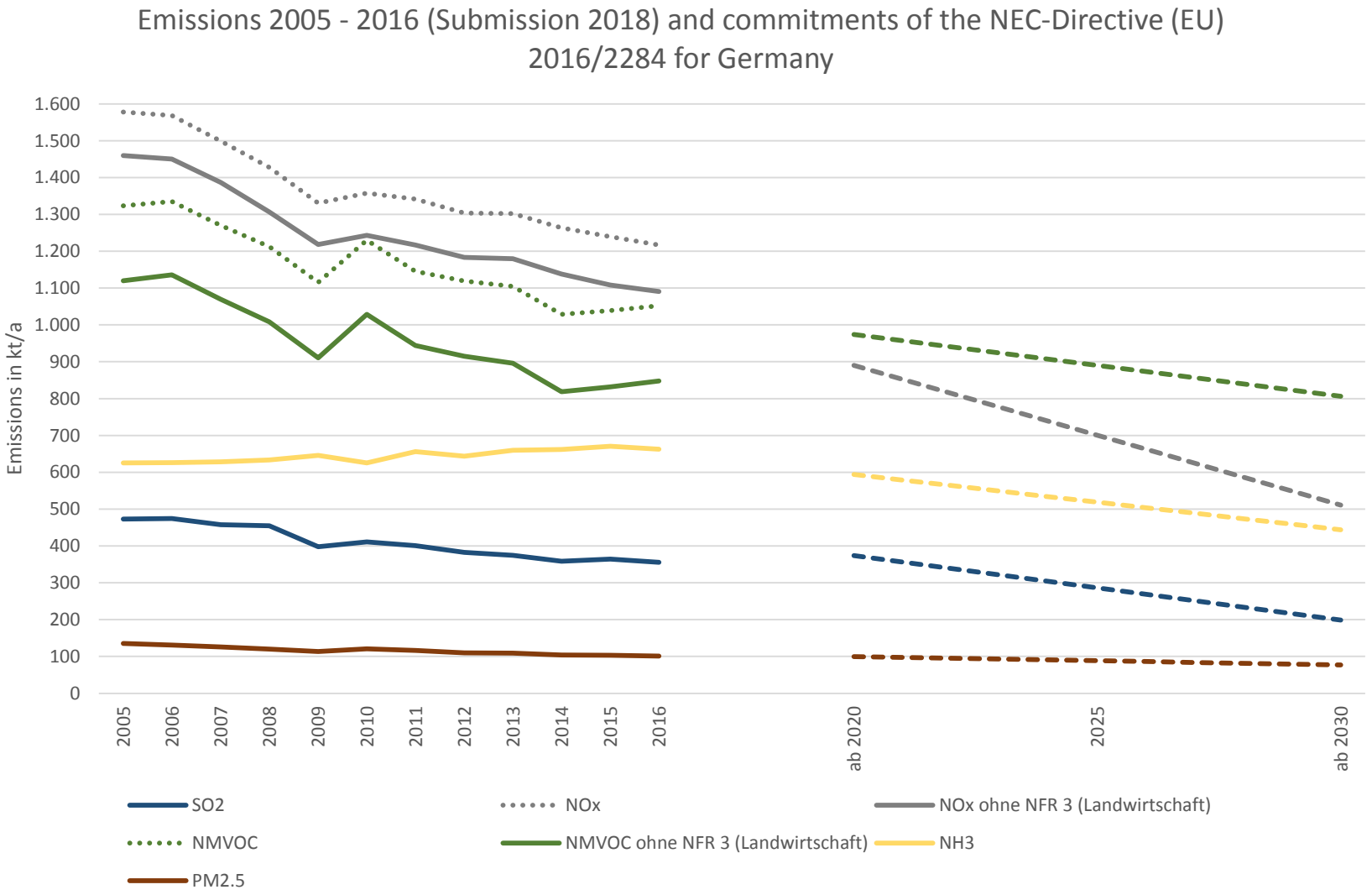
Outline

- National Emissions and Reduction Commitments
- Measures
- Impact on Air Quality – First Estimation
- Study on Health Effects of NO_2-concentrations

Development National Air Pollution Control Programme



Development National Air Pollution Control Programme



Development National Air Pollution Control Programme

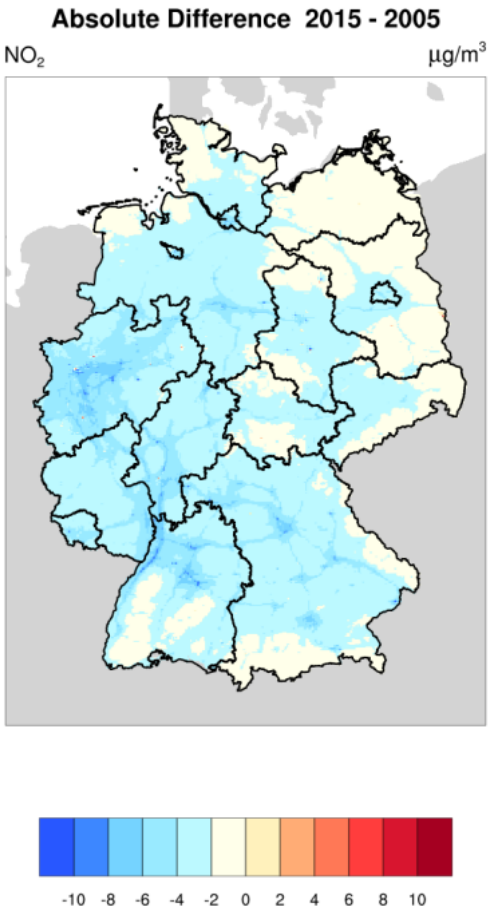
National measures to reduce emissions

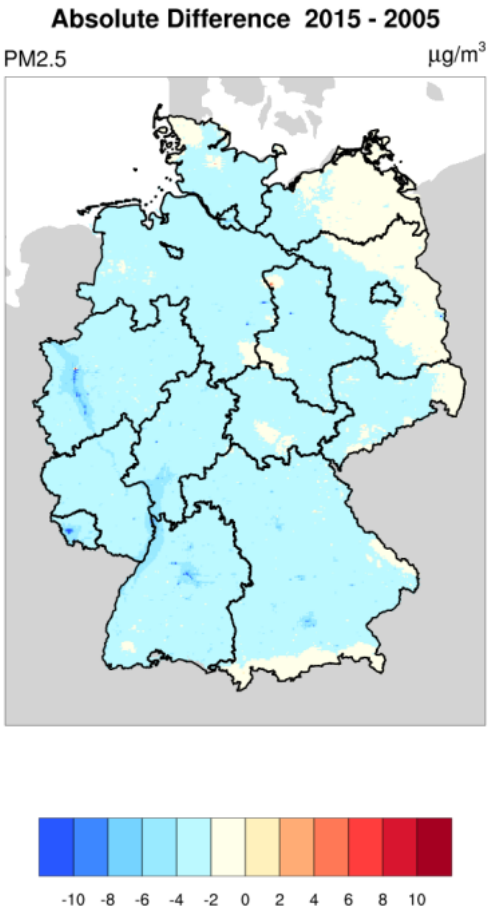
- Large Combustion Plants – LCP BREF/BAT conclusions – 13.BImSchV
- Medium Combustion Plants – MCP-Directive – 44.BImSchV
- Small Stationary Combustion – Ecodesign Directive – 1.BImSchV
- Road Traffic – Fleet renewal through Euro-Standards + Software-Updates and Retrofitting of Cars and Busses + Modal split + E-mobility
- Agriculture – Tackle the whole nitrogen cycle

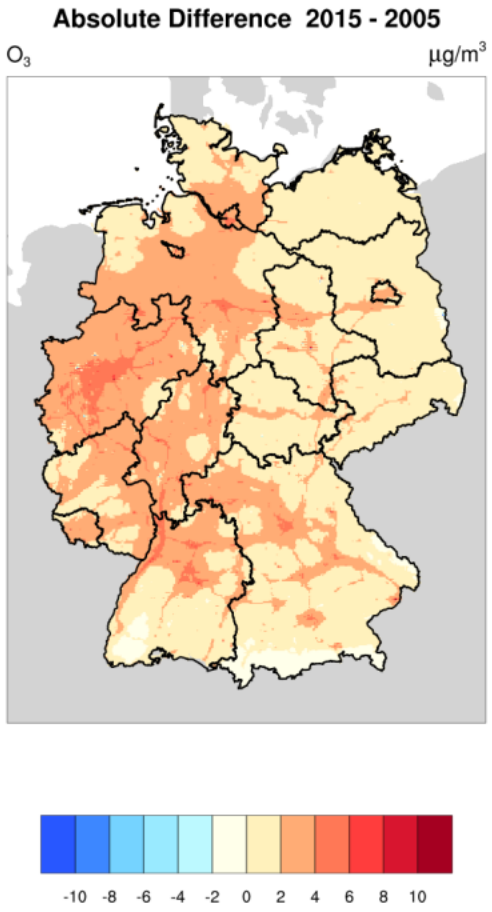
- ? Decarbonization of the energy sector ? (‘Exit from the coal’)

Development National Air Pollution Control Programme

Impact on air quality – CTM – Background concentrations







Development National Air Pollution Control Programme

Impact on air quality – CTM – Background concentrations 2005-2015

Pollutant	mean concentration 2005 µg/m³	mean concentration 2015 µg/m³	absolute difference µg/m³	relative difference %
NO_2	10.46	7.70	**- 2.76**	- 35.8
Ozon	49.42	51.23	**+ 1.81**	+ 3.5
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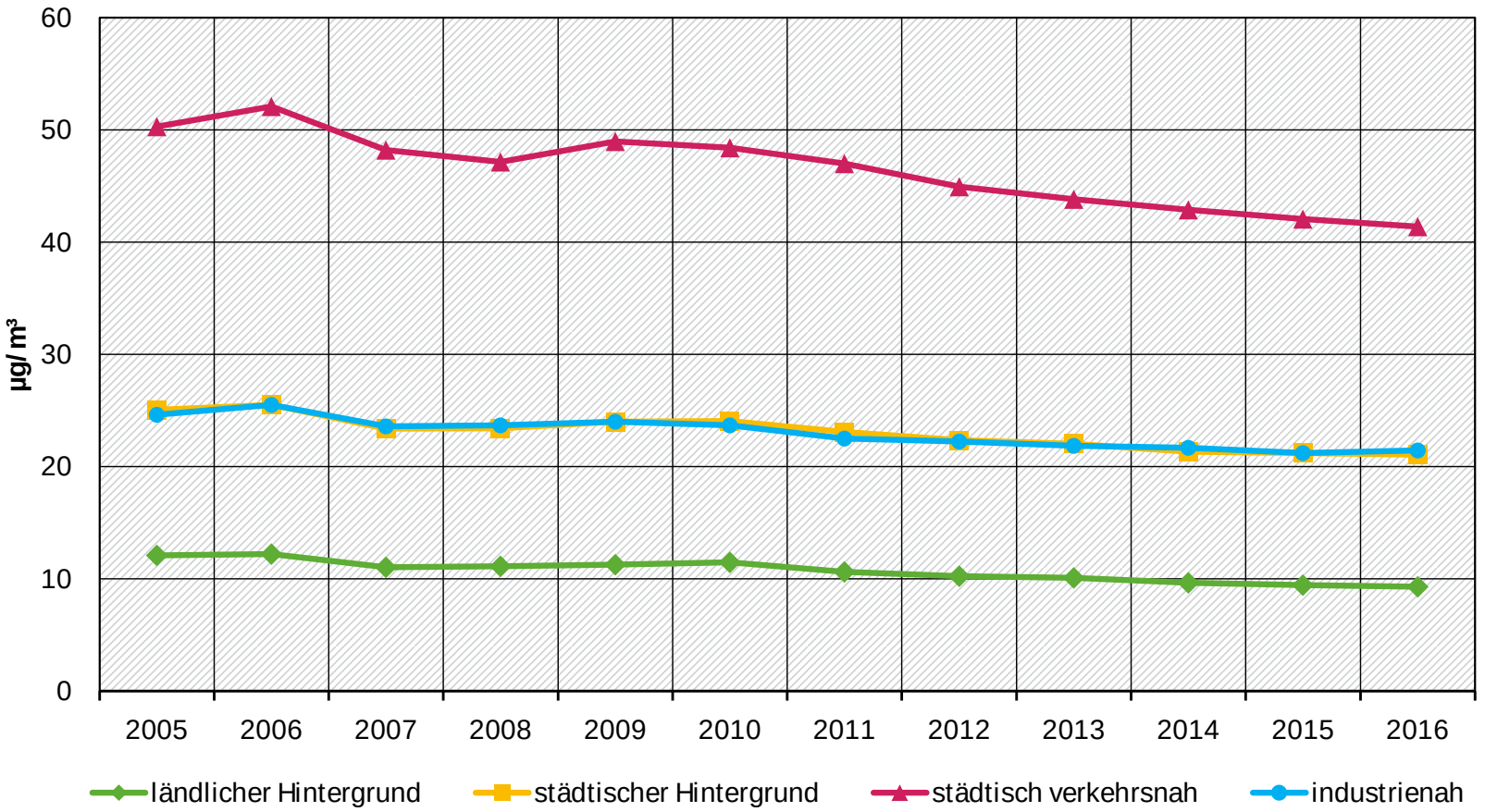
2005-2015

NO_2 emission reduction – 340 kt – 21%

further reduction required till 2030 – 609 kt

Development National Air Pollution Control Programme

NO_2 annual means by station categories 2005-2016



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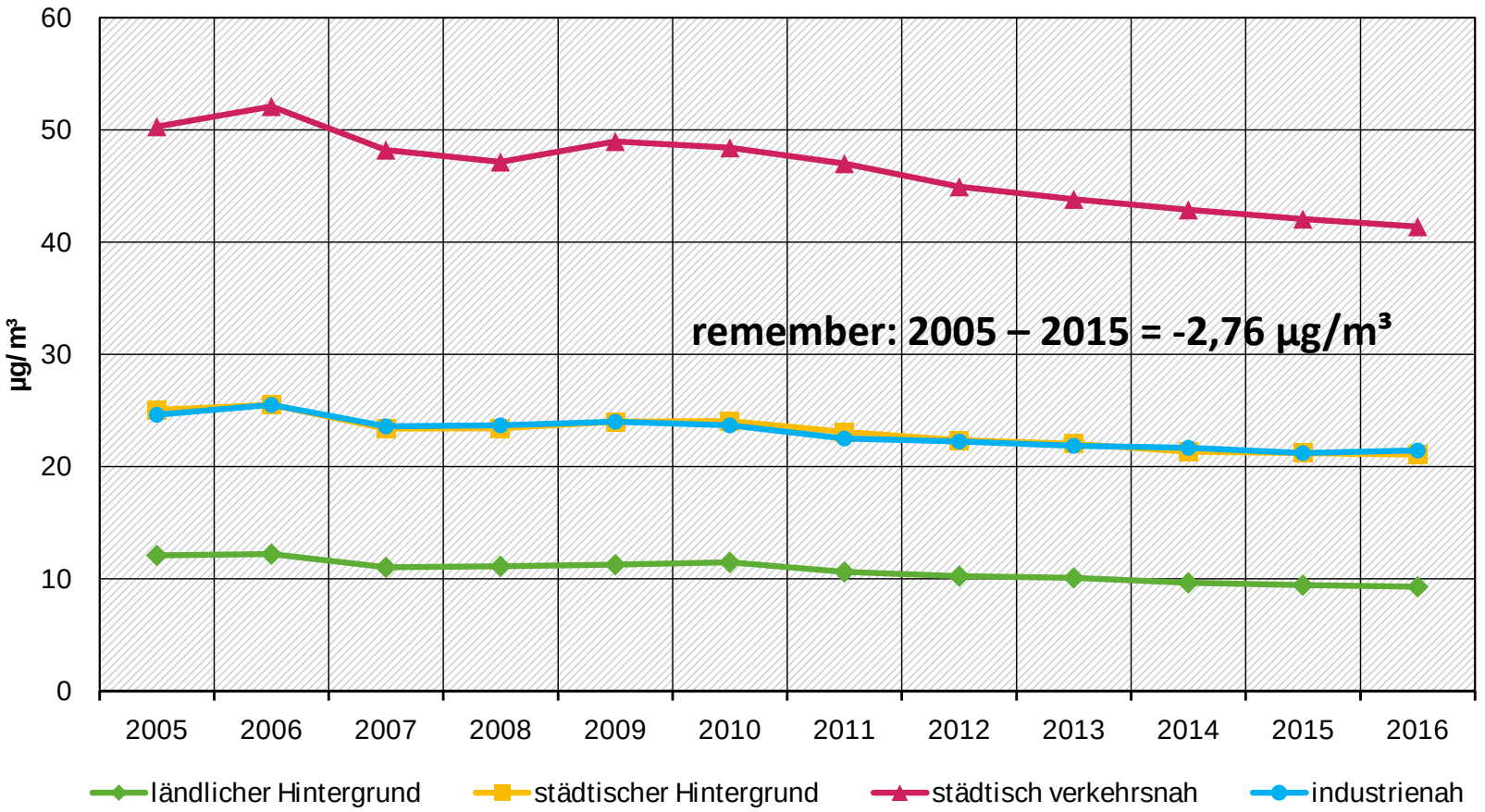

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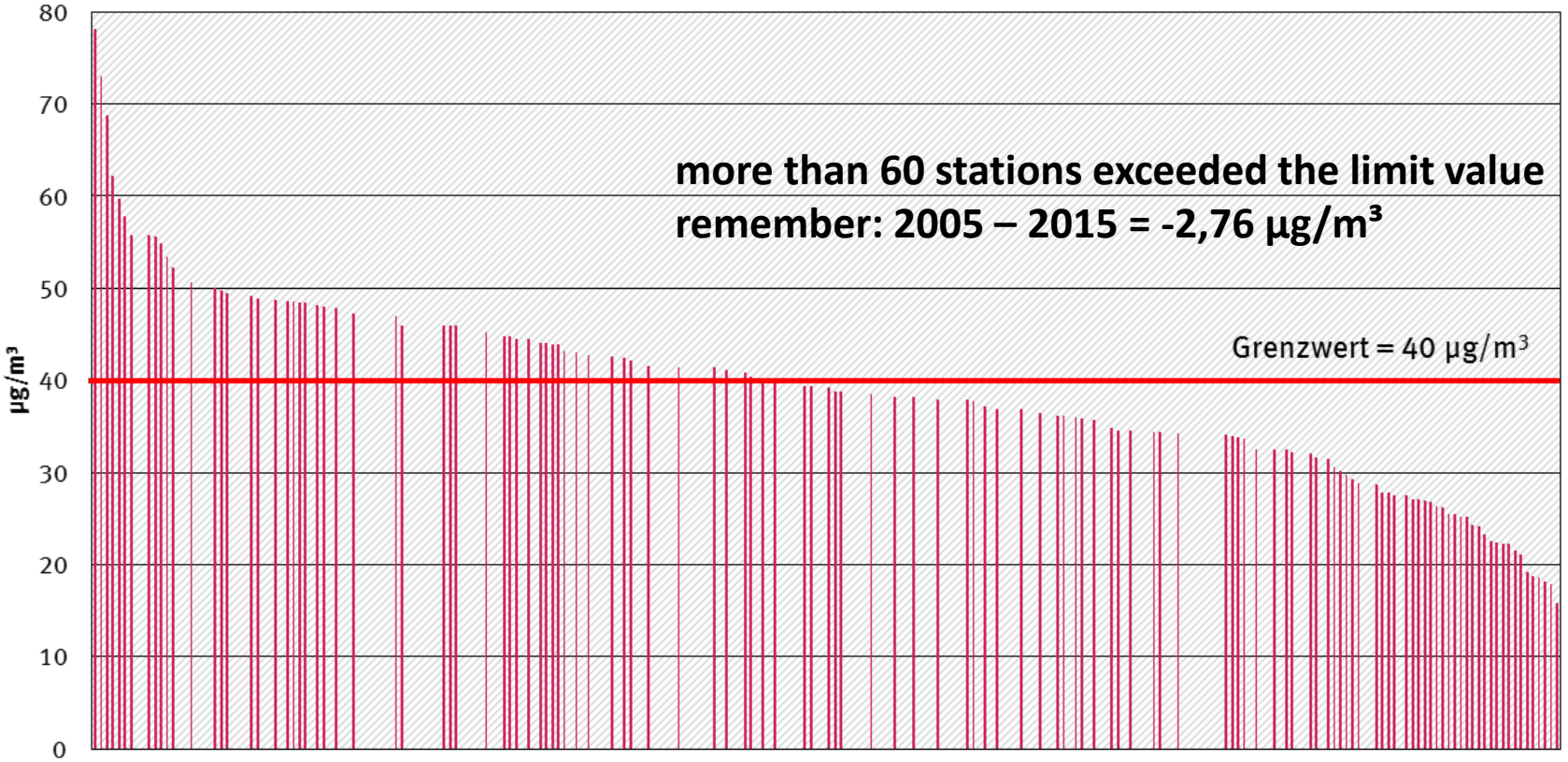
Preliminary evaluation NO_2 exceedances 2017



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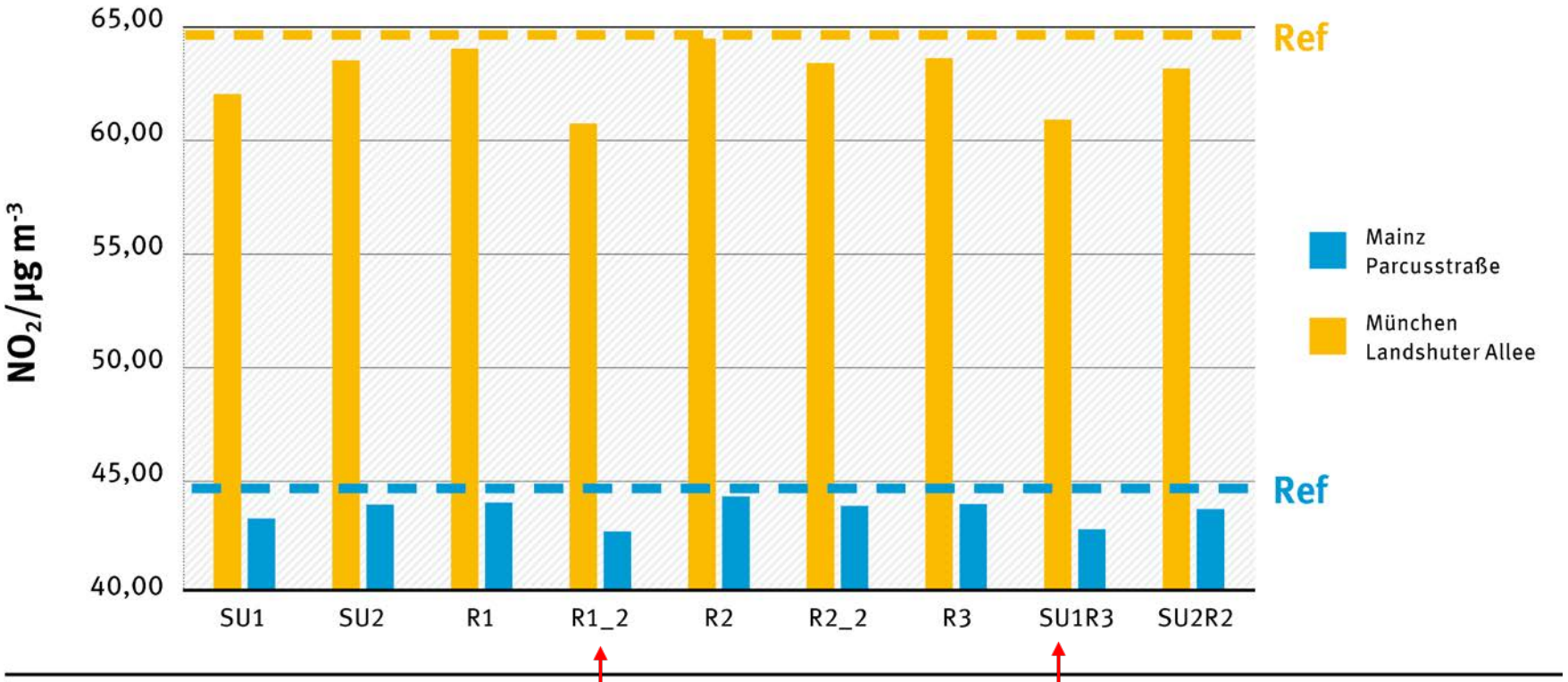
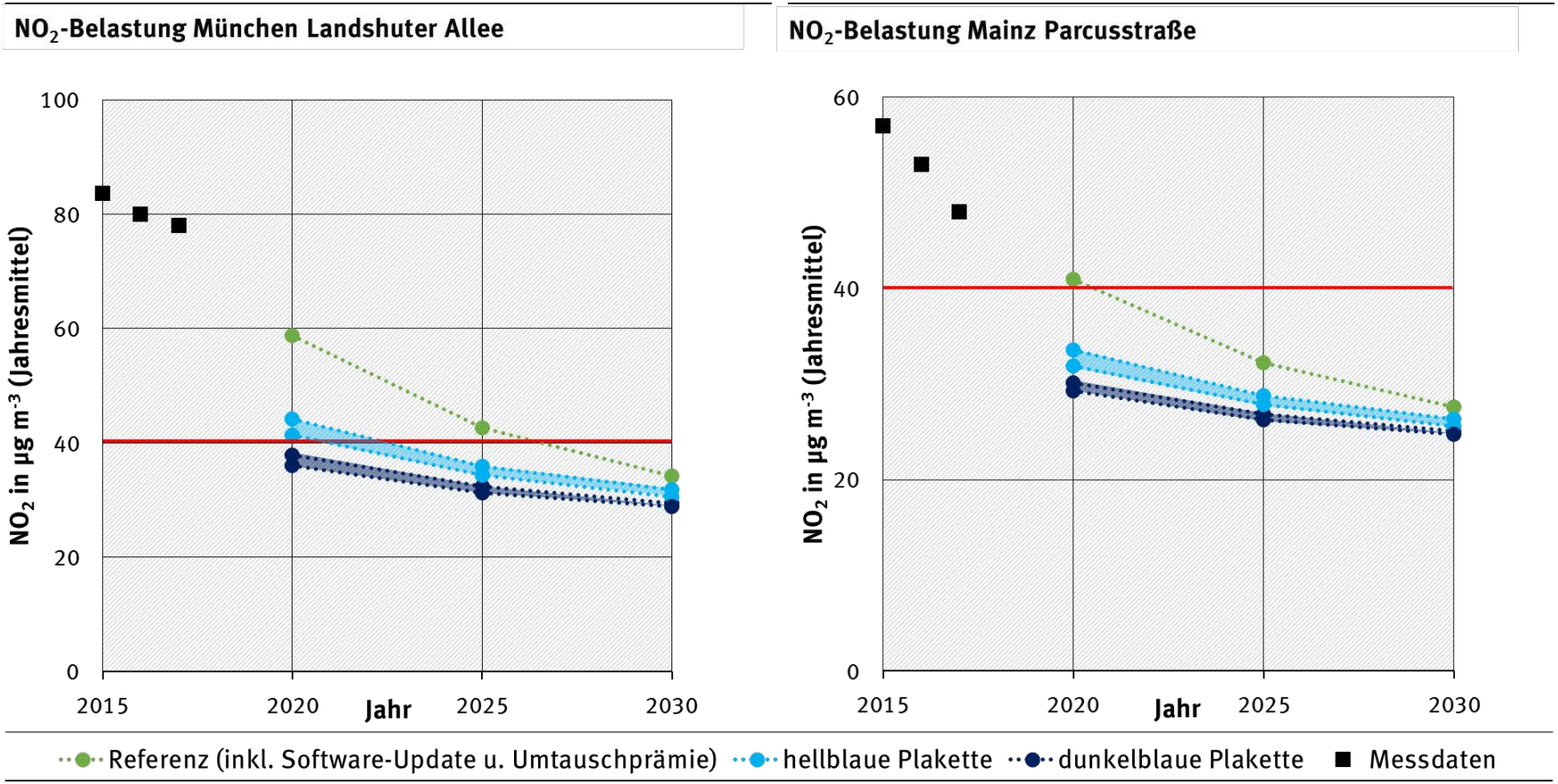
Abschätzung der NO_2-Konzentration im Jahr 2020 an der Landshuter Allee und Mainz Parcusstraße und für die unterschiedlichen Szenarien mit Software-Update (SU), Rückkauf (R) oder der Kombination (SUR) aus Beiden*



* Eine detaillierte Beschreibung der Annahmen in den Szenarien wird in Tabelle 1 gegeben.

Quelle: UBA

Development National Air Pollution Control Programme



Quelle: Umweltbundesamt

Development National Air Pollution Control Programme

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2005-2015

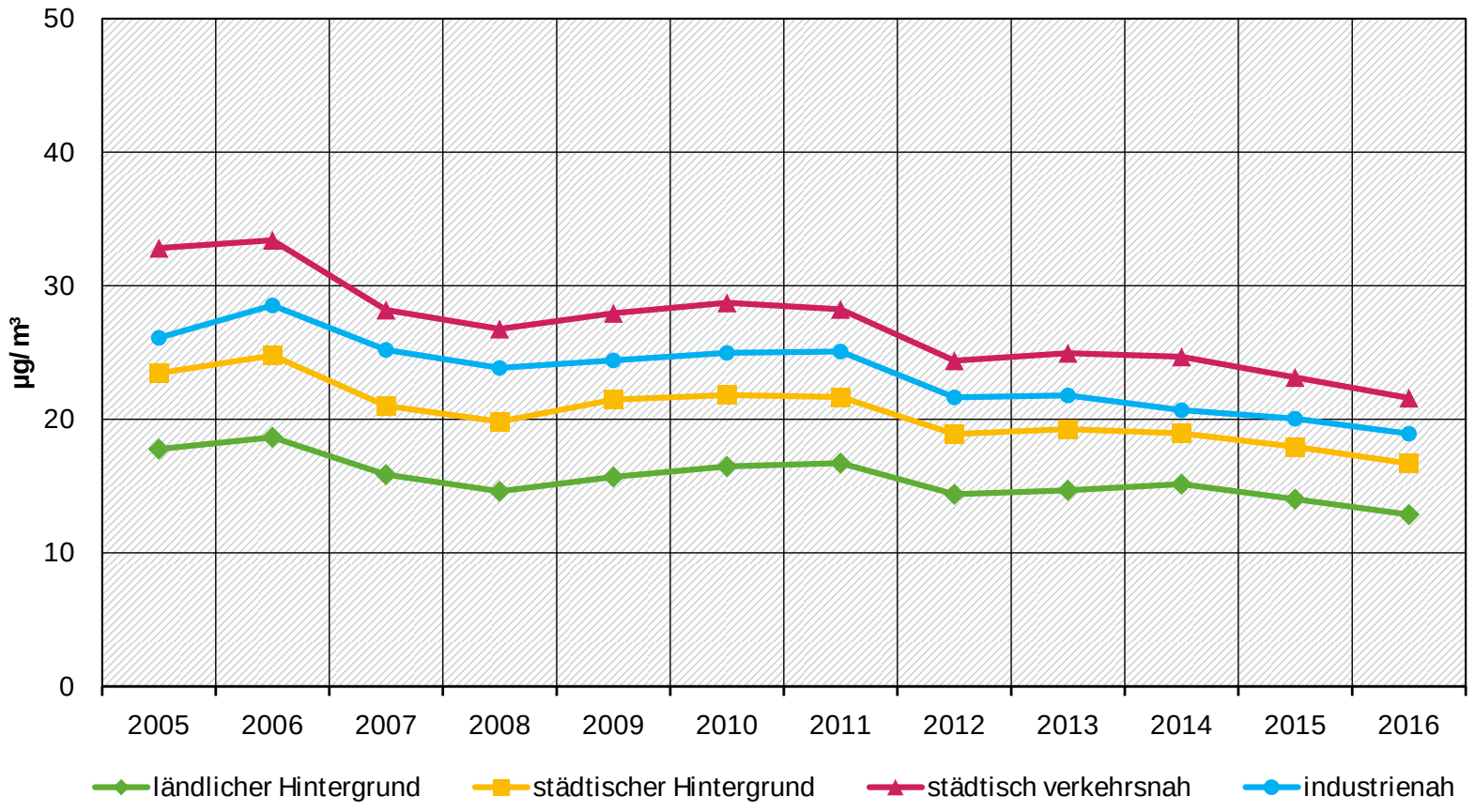
primary$PM_{2.5}$ emission reduction – 32 kt – 24%

further reduction required till 2030 – 21 kt

But there will also be substantial reductions of PM-precursors.

Development National Air Pollution Control Programme

PM_{10} annual means by station categories 2005-2016



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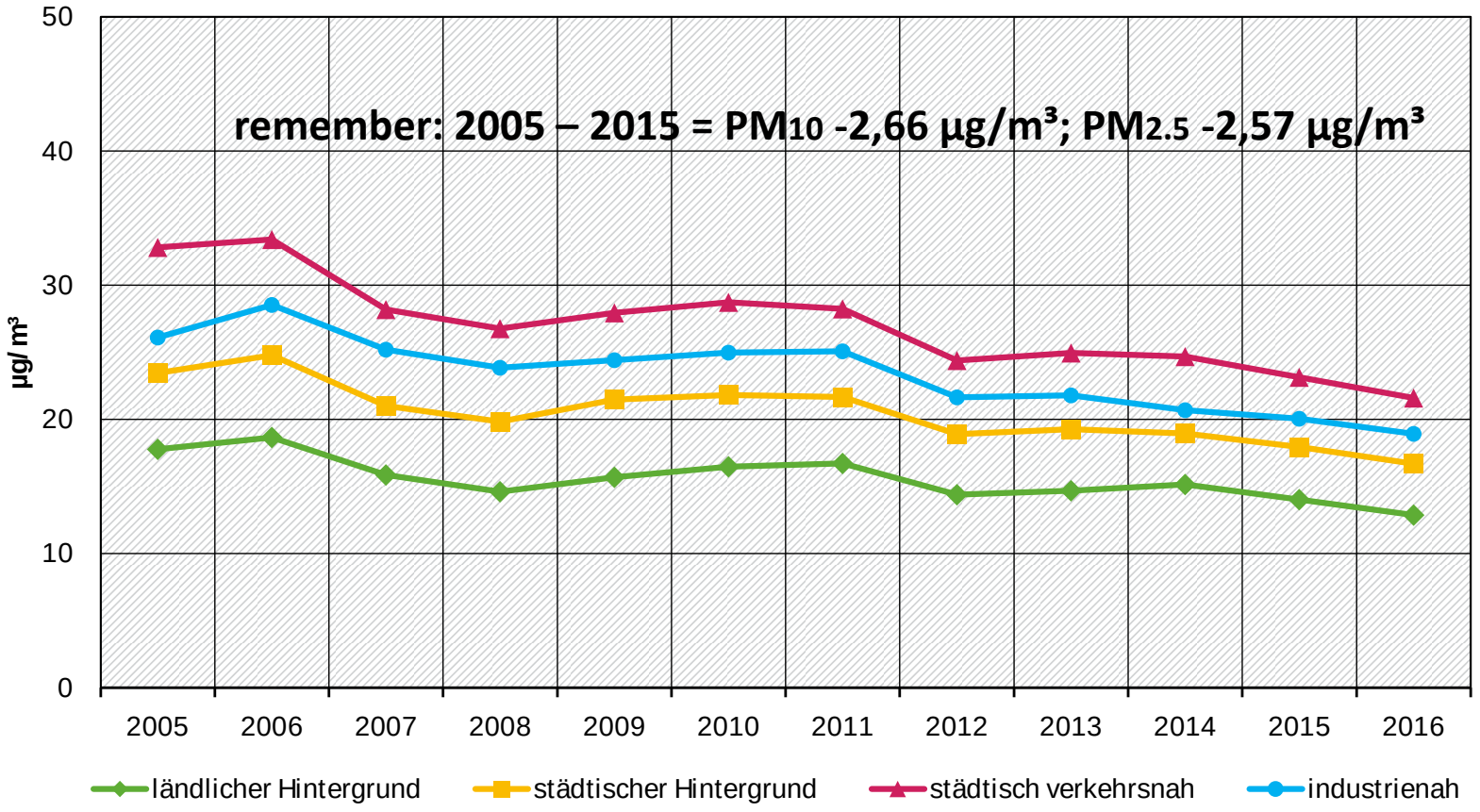

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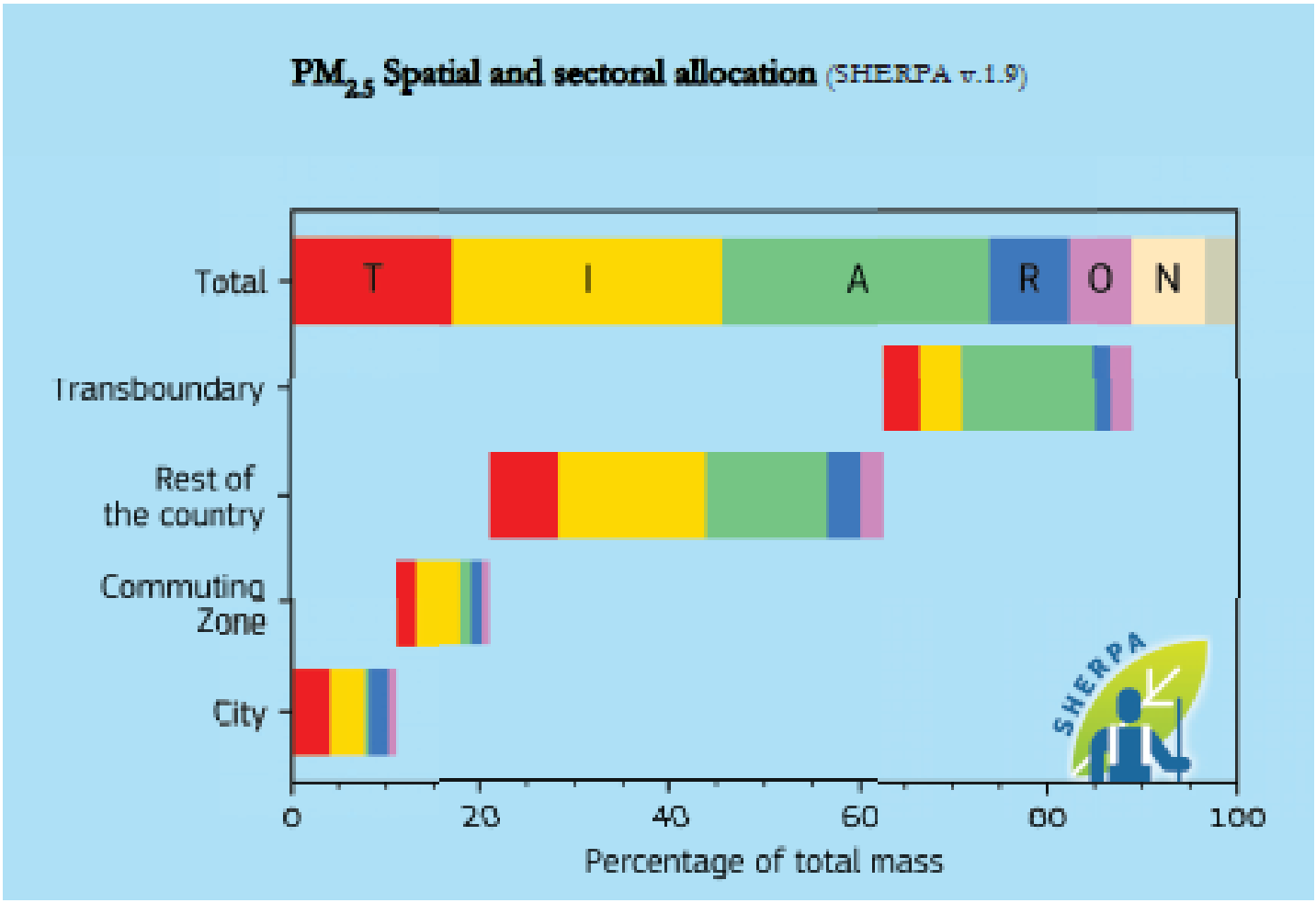
$PM_{2.5}$ JRC – Urban Atlas for Düsseldorf, Germany



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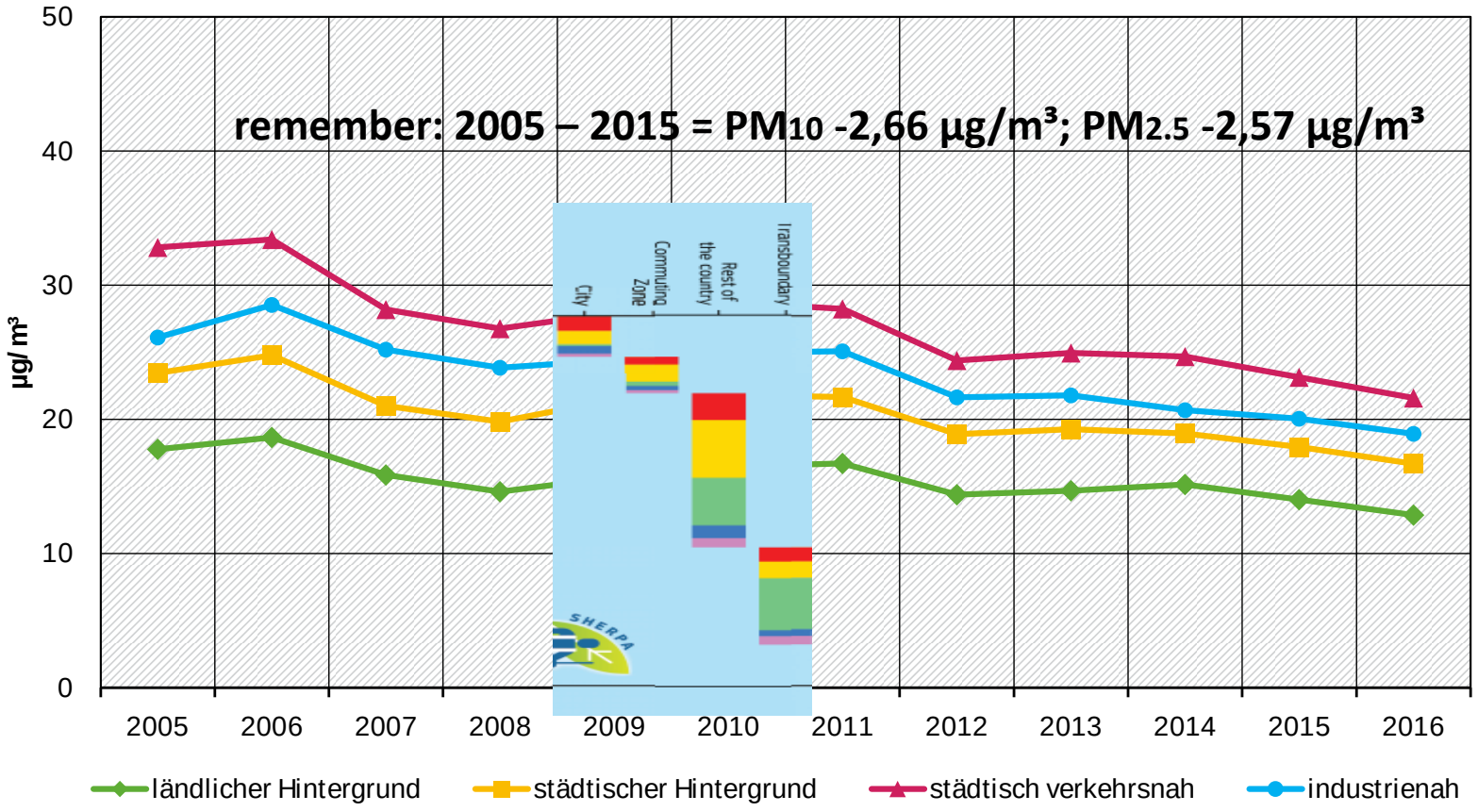
Experiment



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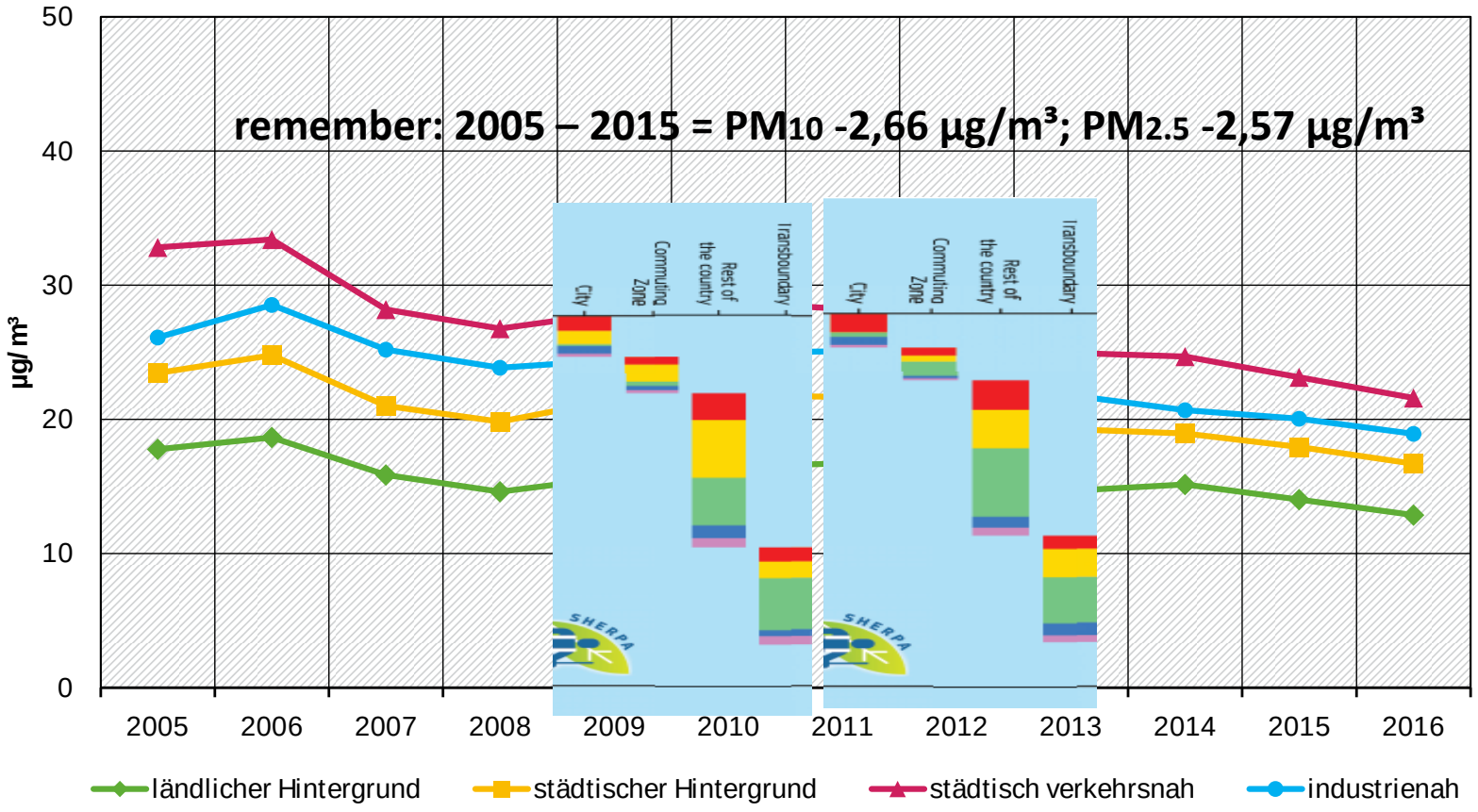
Experiment 2



TSAP Report #12 – Kiesewetter and Amann, IIASA

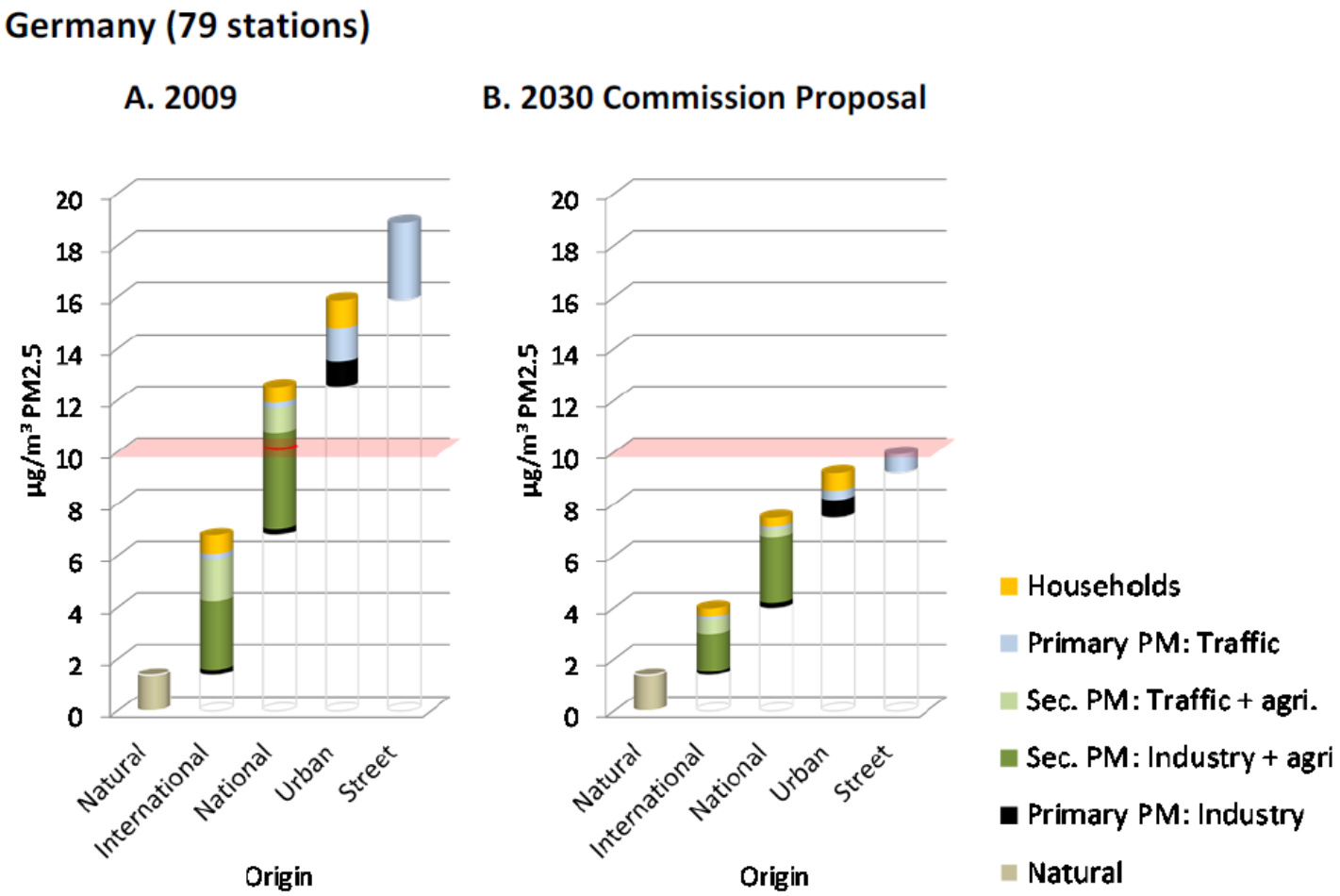


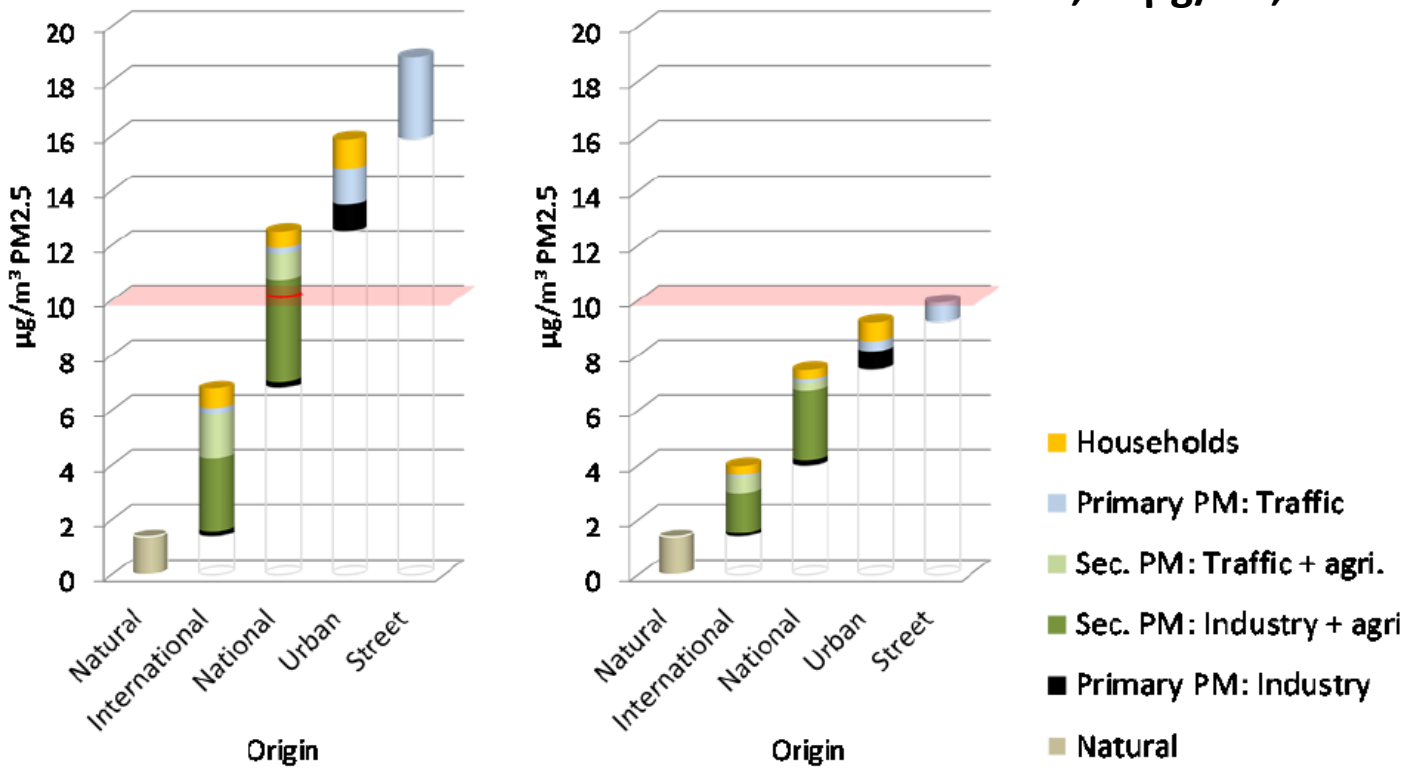
Figure 2.9. Source contributions to ambient PM2.5 at urban traffic stations in Germany, in the base year 2009 (A) and for 2030 assuming adoption of the Clean Air Policy Package proposed by the Commission (B). Source: IIASA GAINS.

TSAP Report #12 – Kiesewetter and Amann, IIASA

Germany (79 stations)

A. 2009 **B. 2030 Commission Proposal**

remember: 2005 – 2015 = PM_{10} -2,66 µg/m³; $PM_{2.5}$ -2,57 µg/m³



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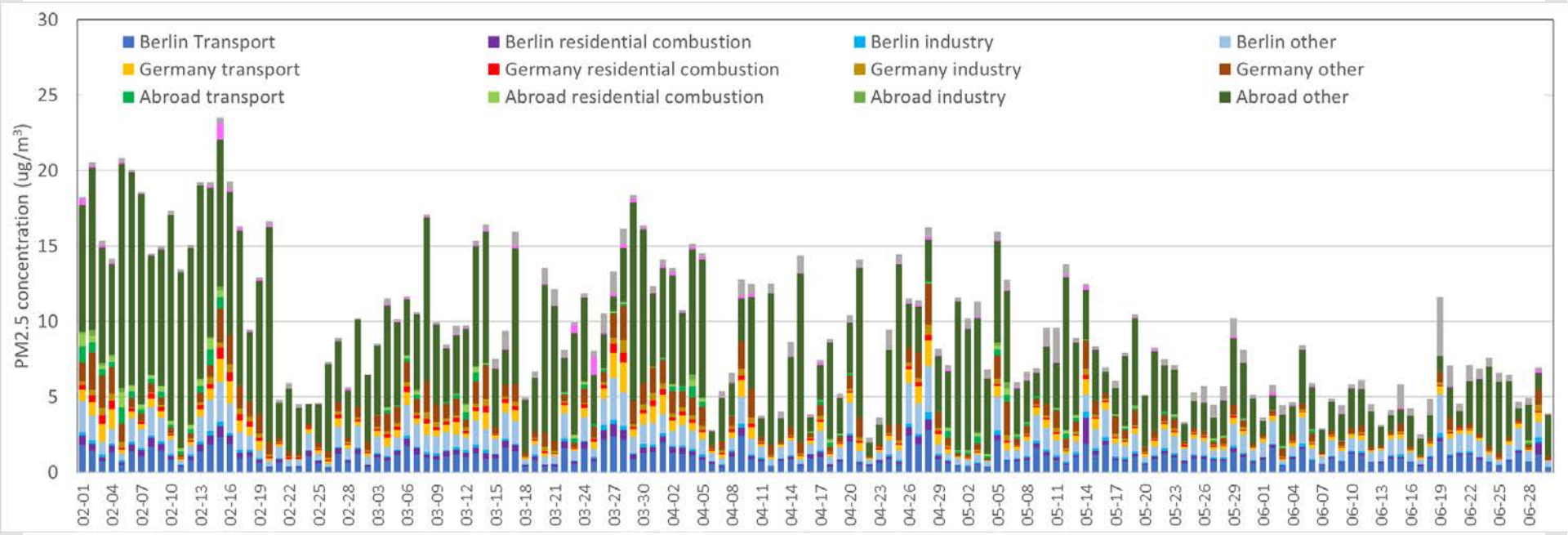

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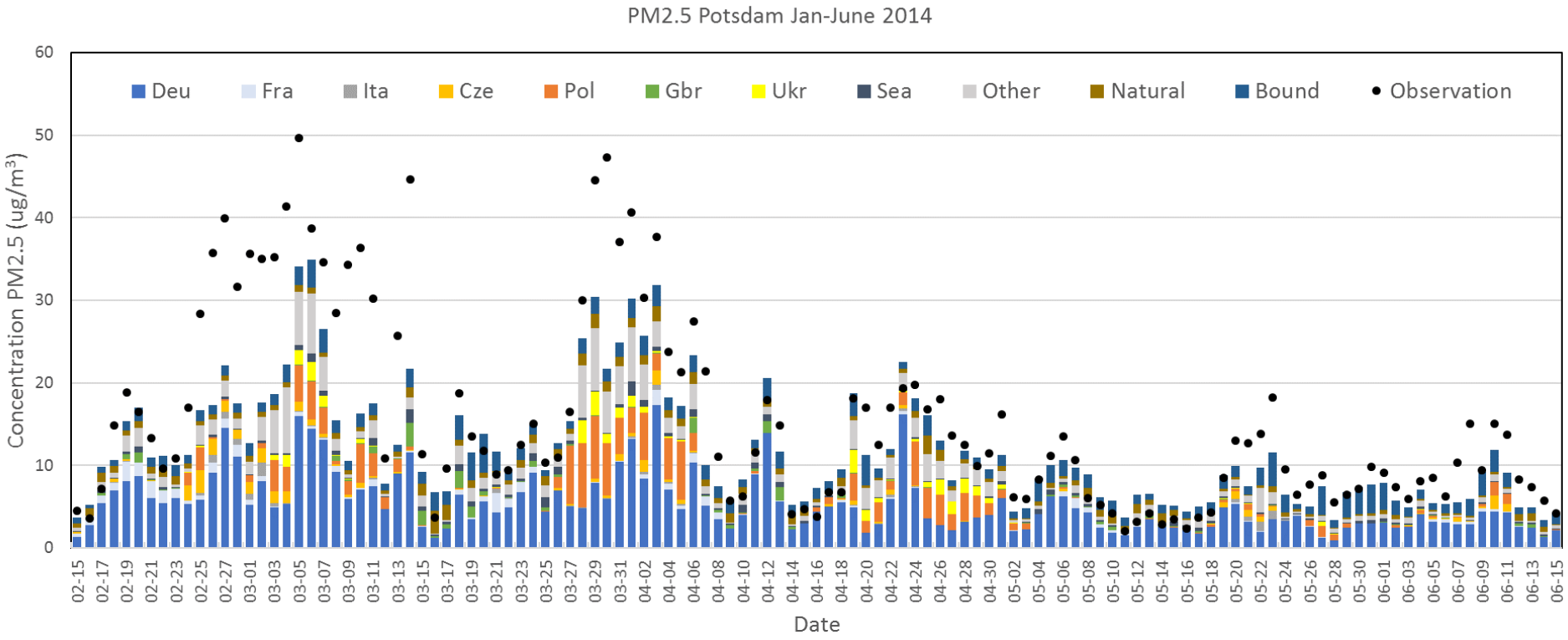

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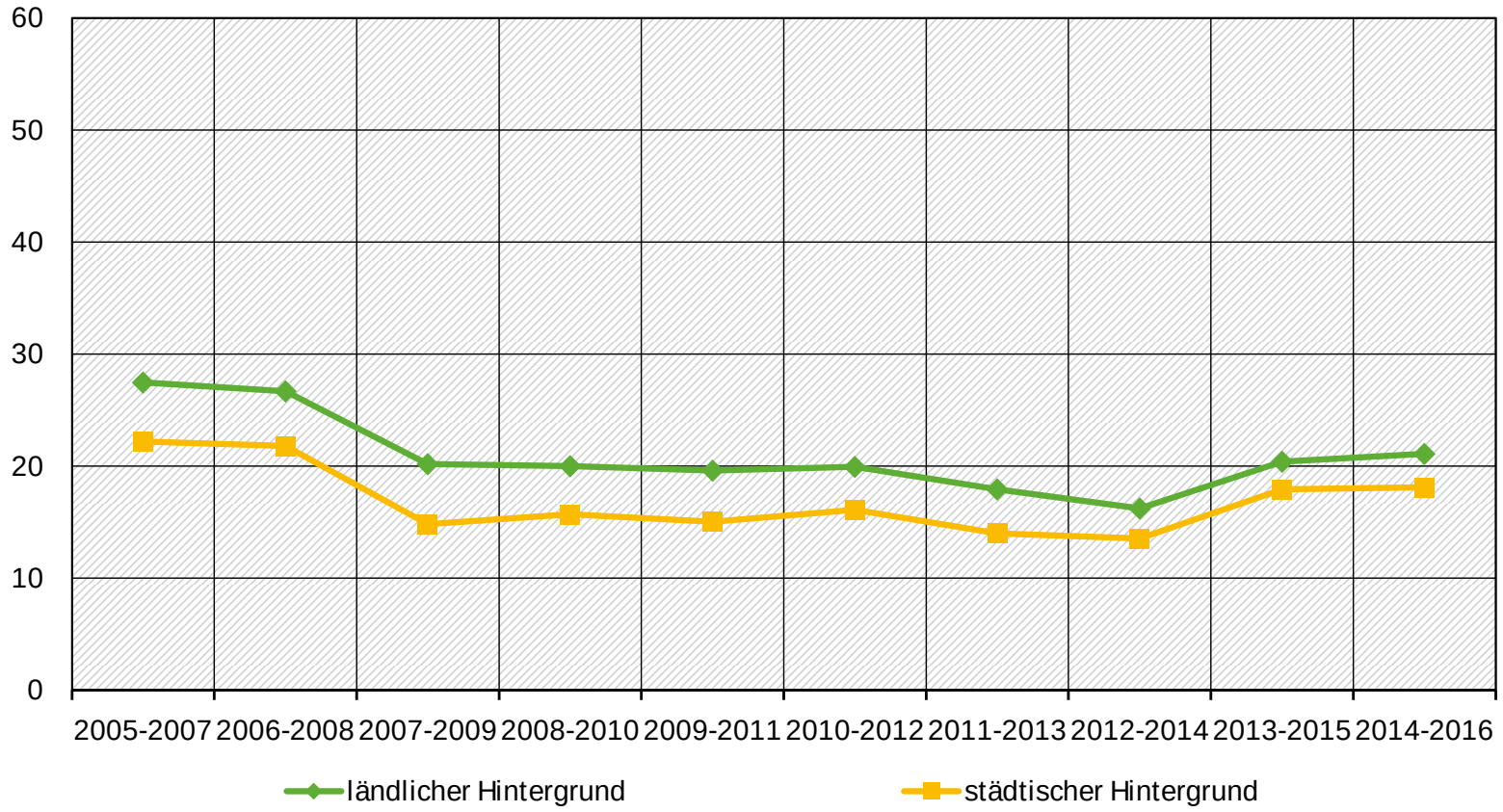
Number of days exceeding O_3-target value of 120µg/m³ (3 year average of max. 8h mean) by station categories 2005-2016



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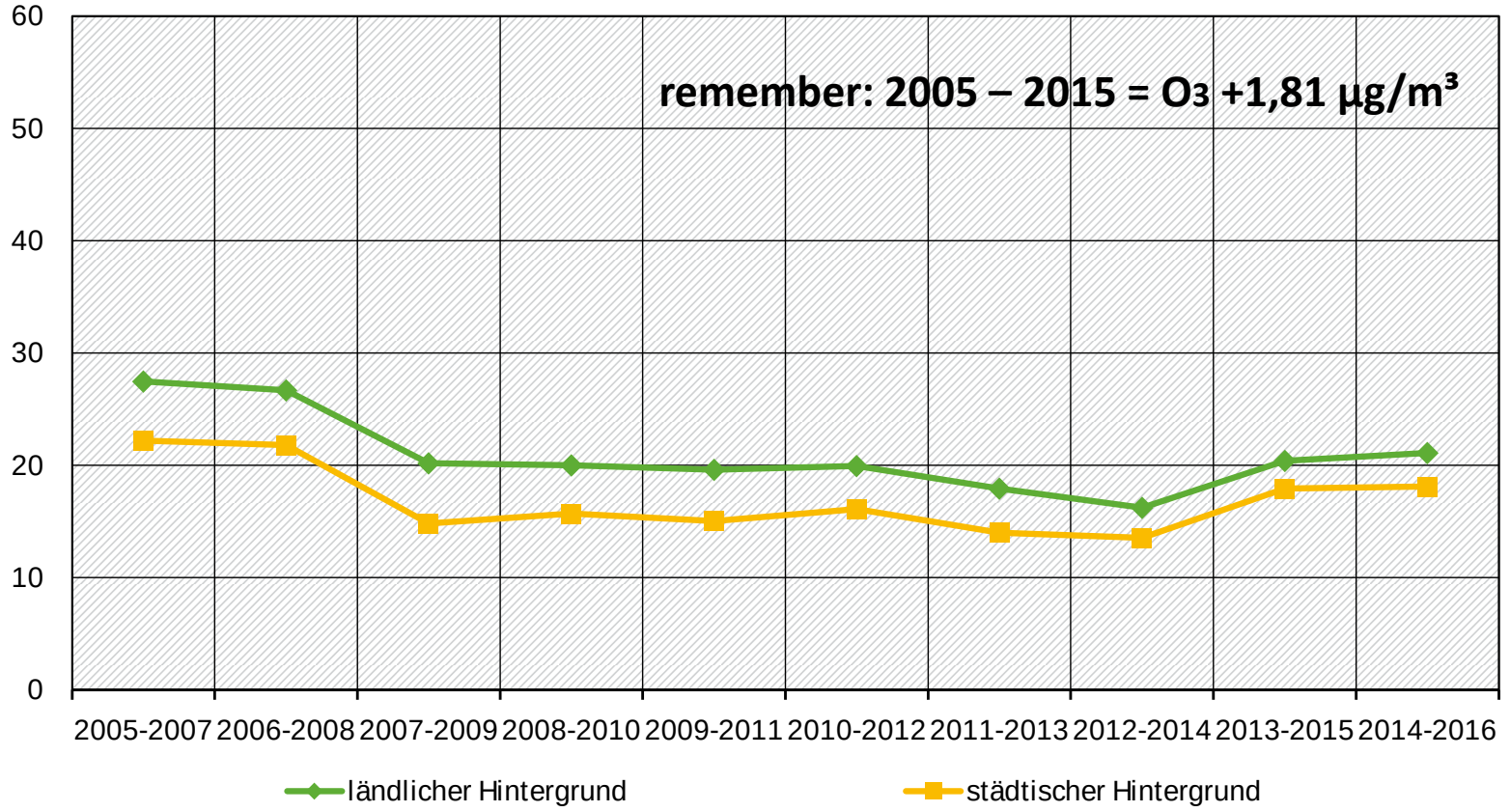


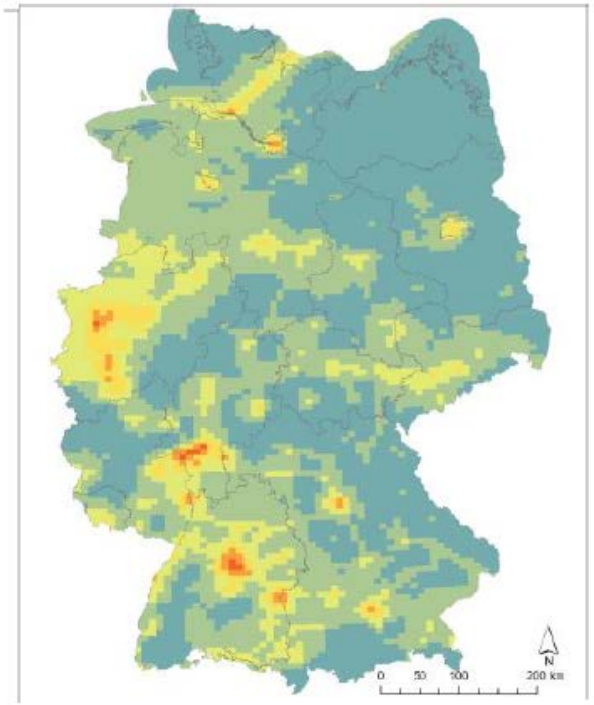
Conclusions

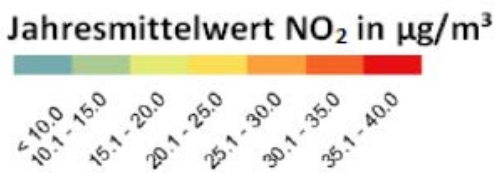
Impact of national measures (NAPCP) on local air quality

- Impact on $PM_{2.5}$ concentrations >> NO_2
- Impact on O_3 is depending on Compliance with the NEC-Directive in all member states (as well as global emission reductions)

Health Impact of NO_2-concentrations

NO_2 modelled background concentration - annual mean





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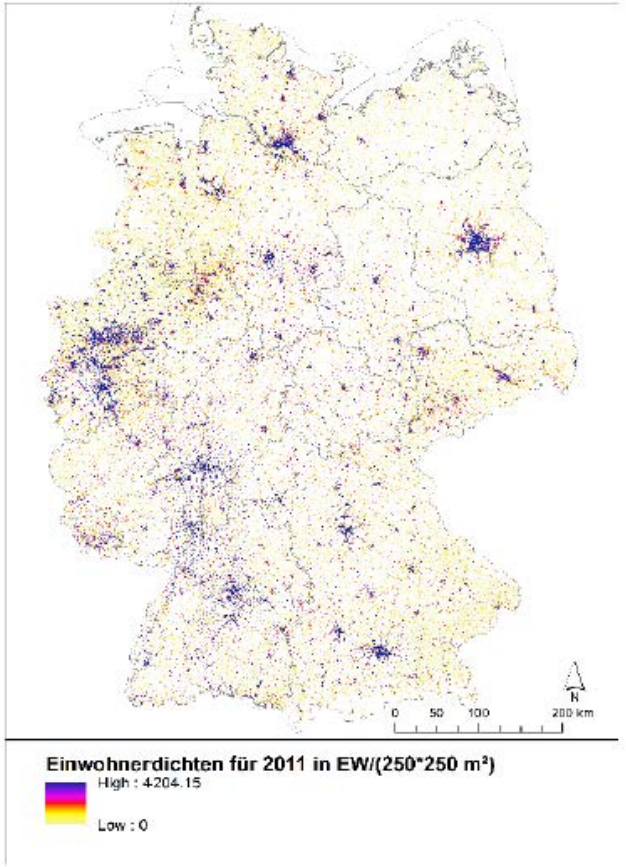
Population Density 2011



Health Impact of NO_2-concentrations

High evidence of epidemiological studies only for cardiovascular mortality

Endpunkt	Anzahl ermittelter Studien	Anzahl Studien nach Anwendung der K.O.-Kriterien	Anzahl Studien nach Prüfung der Übertragbarkeit nach Deutschland
Gesamtmortalität	26	23	--
Kardiovaskuläre Mortalität	21	20	6
Respiratorische Mortalität	22	18	--
Diabetes	15	9	5 (Mortalität: 2; Morbidität: 3)
Bluthochdruck	11	Erwachsene: 5 Kinder: 1	3 (Mortalität: 0; Morbidität: 3)
Ischämische Herzkrankheiten	21	16	10 (Mortalität: 8; Morbidität: 2)
Herzinfarkt	5	4	--
Herzinsuffizienz	3	3	3 (Mortalität: 1; Morbidität: 2)
Schlaganfall	22	16	8 (Mortalität: 5; Morbidität: 4))
Lungenkrebs	37	19	--
COPD	15	8	2 (Mortalität: 1; Morbidität: 1)
Chronische Bronchitis	2	2	--
Asthma	41	Erwachsene: 5 Kinder: 20	Erwachsene: 3 (Mortalität: 0; Morbidität: 3) Kinder: --

Health Impact of NO_2-concentrations

High evidence of epidemiological studies only for cardiovascular mortality

Only around 2% of cardiovascular mortality is attributable to NO_2

Kennzahl	2007	2008	2009	2010	2011	2012	2013	2014
Attributabler Anteil (%)	2,19	2,29	2,26	2,26	1,86	1,87	1,58	**1,77**
Attributable Todesfälle	7.832	8.157	8.035	7.960	6.343	6.531	5.605	**5.966**
YLL	69.244	71.396	69.526	68.428	53.489	54.536	46.795	**49.726**
YLL je 100.000 Einwohner	123	126	123	121	94	95	83	**88**

Health Impact of NO_2-concentrations

High evidence of epidemiological studies only for cardiovascular mortality

Only around 2% of cardiovascular mortality is attributable to NO_2

Critique: **Combined Impact of $PM_{2.5}$, NO_2 and O_3**

	Hazard ratio	Attributabler Anteil in %	Years of Life Lost
Hauptanalyse	1,030	1,77	49.726
Expositions-Wirkungsfunktion für europäische Studien Faustini et al. (2014)	1,059	3,45	97.196
Expositions-Wirkungsfunktion nach Adjustierung für $PM_{2.5}$ und O_3 Turner et al. (2016)	1,016	0,96	26.995

Health Impact of NO_2-concentrations

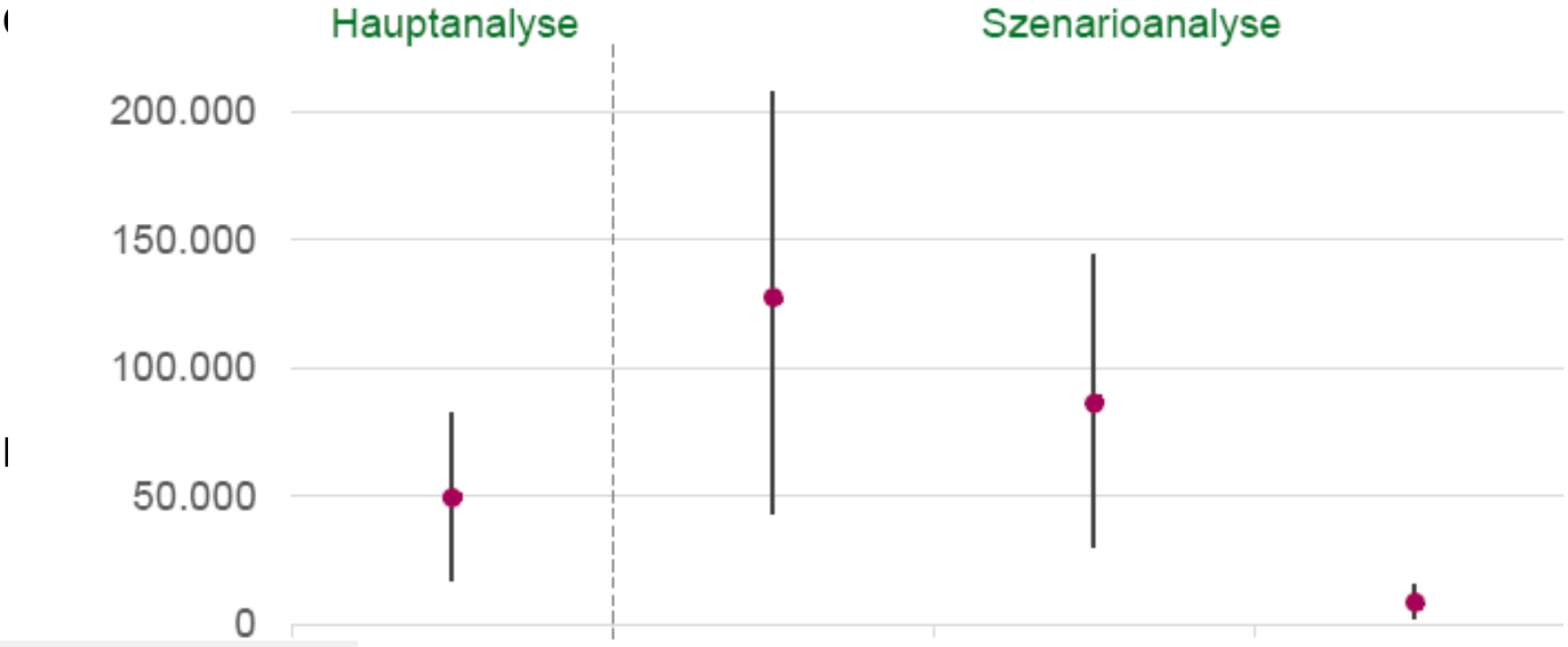
High evidence of epidemiological studies only for cardiovascular mortality
Only around 2% of cardiovascular mortality is attributable to NO_2

Critique:	**Combined Impact of $PM_{2.5}$, NO_2 and O_3** **NO_2 may only mask UFP-effects** **higher risks through PM (factor 10), but limit value higher than WHO-guidelines, so it's not in focus** **long term exposition can not be concluded from place of residence**
Pro:	**Conservative Estimation quantifying the minimum effect of NO_2, showing at least that there is an effect**

Health Impact of NO_2-concentrations

High evidence of epidemiological studies only for cardiovascular mortality

Only around 2% of cardiovascular mortality is attributable to NO_2



Years of Life Lost (YLL)

Thank you very much for your attention!

Andreas Eisold

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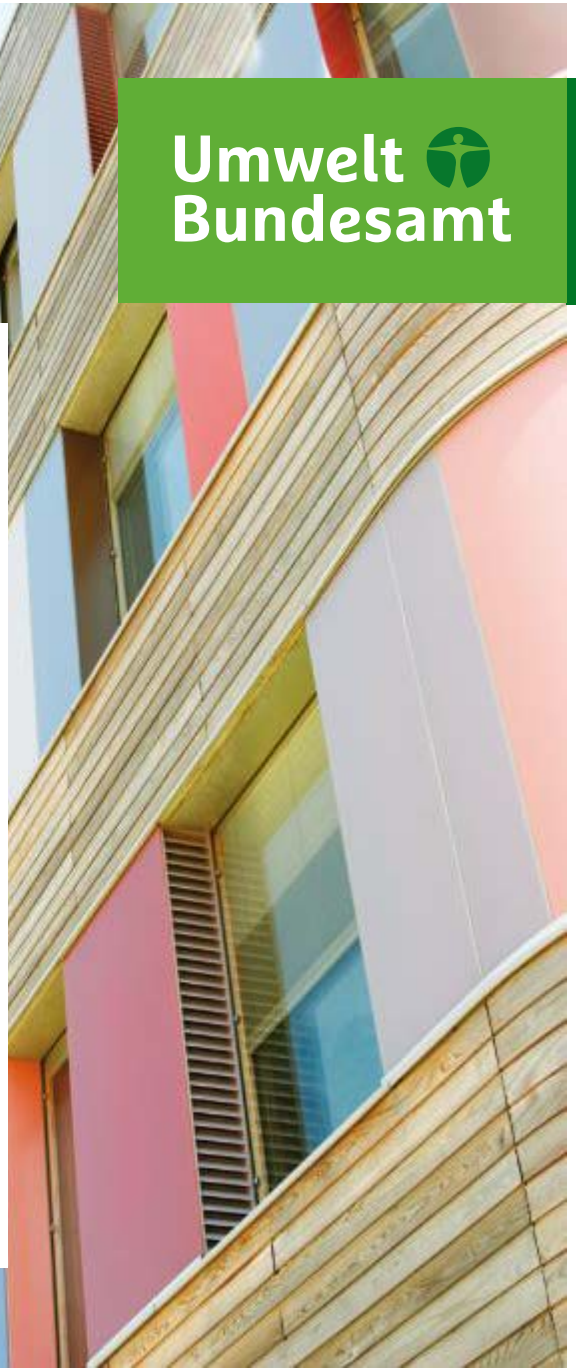
http://www.umweltbundesamt.de/en/topics/air



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