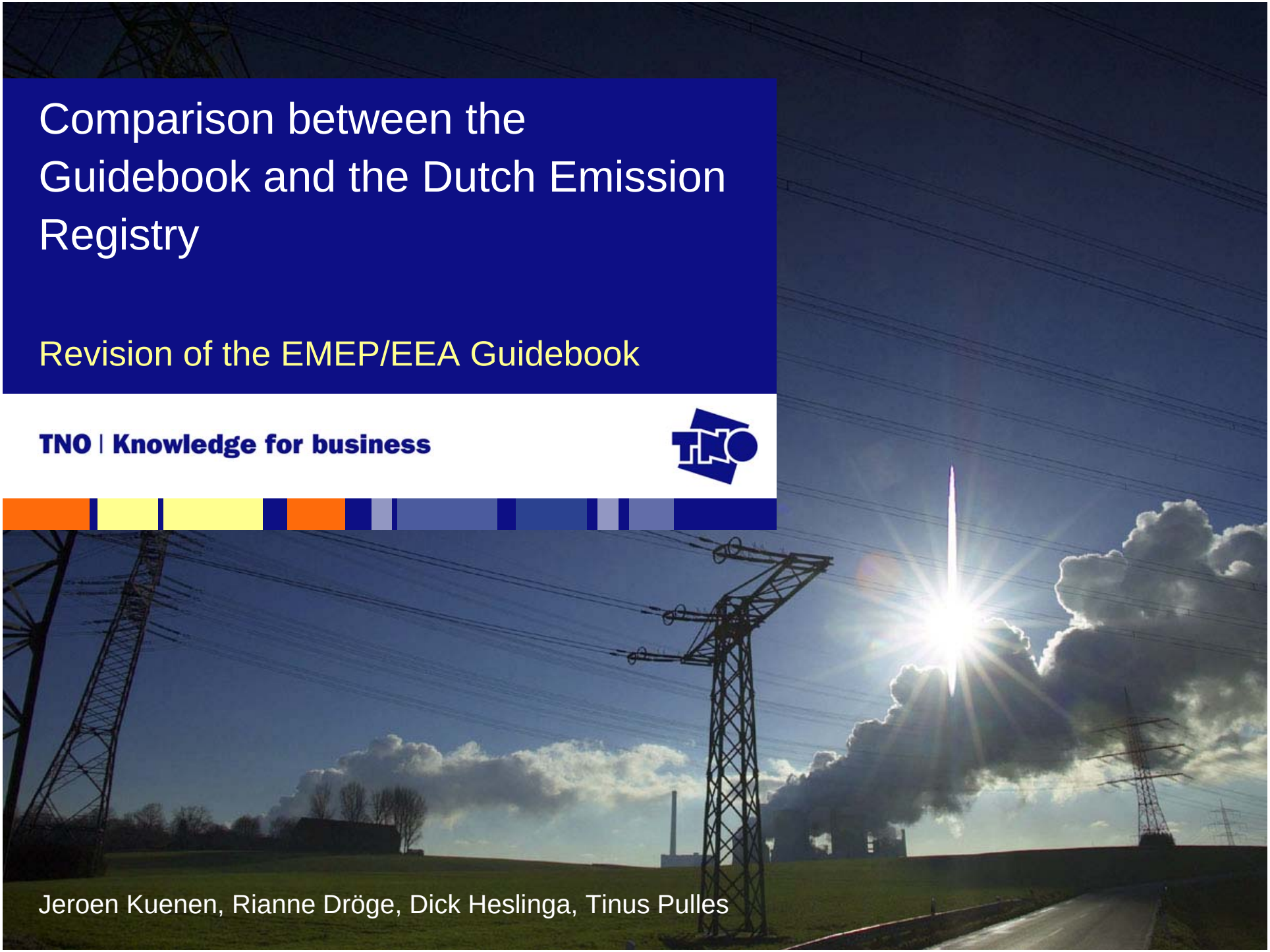
Comparison between the Guidebook and the Dutch Emission Registry

Revision of the EMEP/EEA Guidebook

TNO | Knowledge for business



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Outline

- Introduction to the EMEP/EEA Guidebook
- Revision process (2007-2008, TNO & AEA Technology)
  - Purpose
  - Restructuring to simplify emission inventorying
  - Problems
  - Result
- Application of the revised Guidebook
  - Comparison to the Dutch emission inventory
  - Results, differences and similarities
  - Discussion and conclusions

International requirements

- UNFCCC: climate change (GHG inventories)
- UNECE LRTAP: acidification, eutrofication, tropospheric ozone precursors, heavy metals, persistent organic pollutants (POPs)
- Several EU Directives derived from this
  - Countries agreed to stabilise/reduce emissions
  - Countries agreed to show compliance (transparency, reporting)
- UNECE Aarhus Convention: “Community Right to Know”
  - EPER / E-PRTR (facilities level)
  - E-PRTR Diffuse sources
  - Completely different perspective

Emission Inventory Guidance

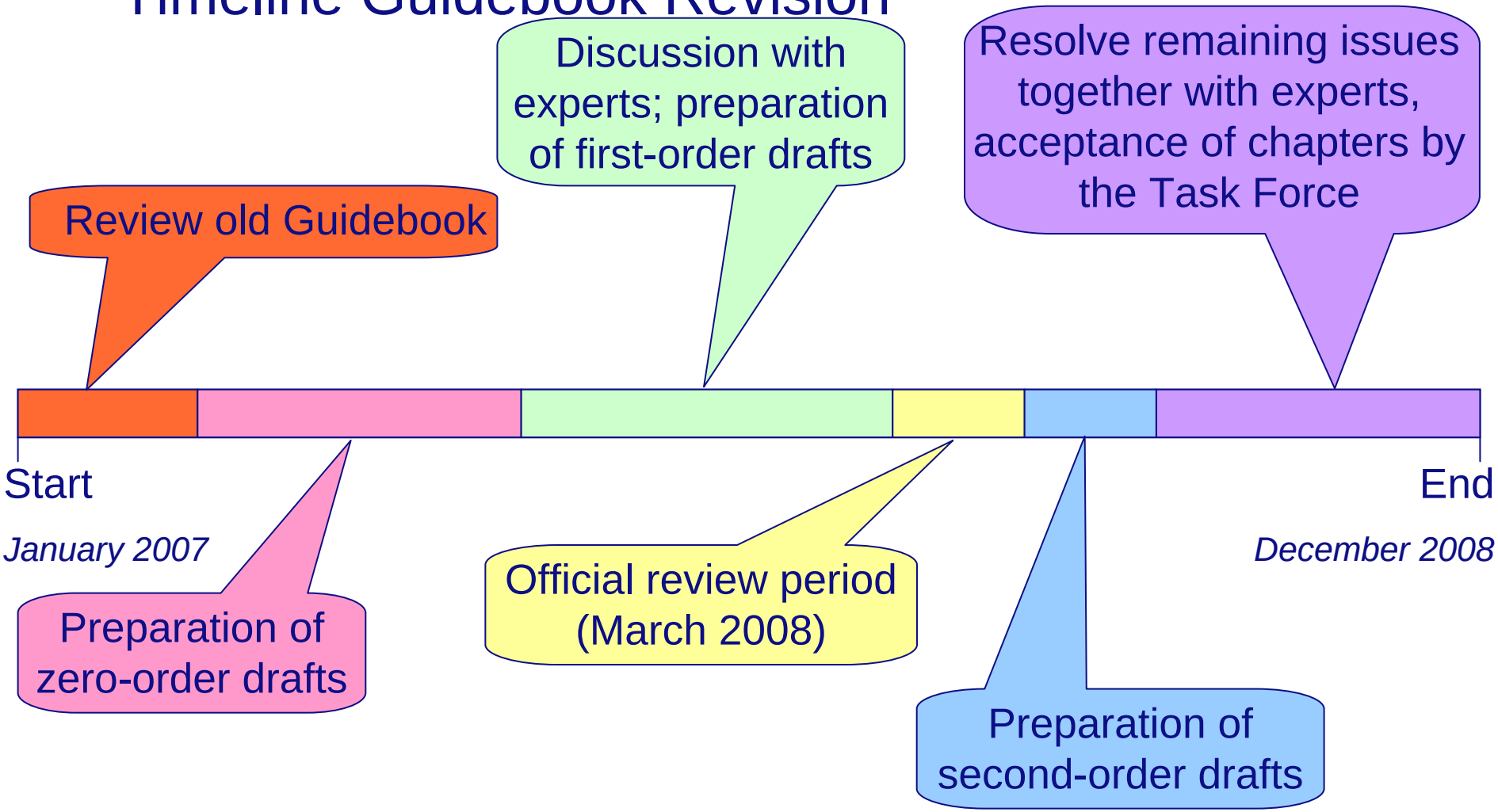
	Procedural Guidance	Technical Guidance
Climate Change	UNFCCC Guidelines for Reporting and Review	IPCC Guidelines
Air Pollutants	LRTAP Emission Reporting Guidelines	EMEP/EEA Guidebook
	What, when, how? Commitment!	*How to do what you committed yourself to do?*

Guidebook Revision project

- Old Guidebook difficult to use for making an emission inventory (intransparency, incompleteness)

- European Commission has financed a major restructuring and updating of the Guidebook, to be carried out by TNO and AEA Technology, with as main goal:
  - Harmonizing emission inventorying in various countries
  - Harmonizing with IPCC where possible
  - Structuring Guidebook along the same source definitions (NFR) as used in the reporting requirements for LRTAP
  - Scientific updating where possible and necessary
  - Development of an emission factor database, in order to be able to easily update and maintain numerical information (emission factors)

Timeline Guidebook Revision



Information

- Review old Guidebook and extract relevant information
  - Source descriptions
  - Methodology descriptions
  - Emission factors
  - Other relevant information

- Introduce new information
  - Scientific literature
  - IPCC Guidelines for Greenhouse Gas Inventories
  - BREF documents (Best Available Technologies) for industry
  - US EPA AP-42
  - Workshops with experts from science & industry

Methods for estimating emissions

- As for greenhouse gases (IPCC 2006 Guidelines), 3 method types are distinguished:
  - Tier 1: “simple method”

$$E_{pollutant} = AR_{production} \times EF_{pollutant}$$

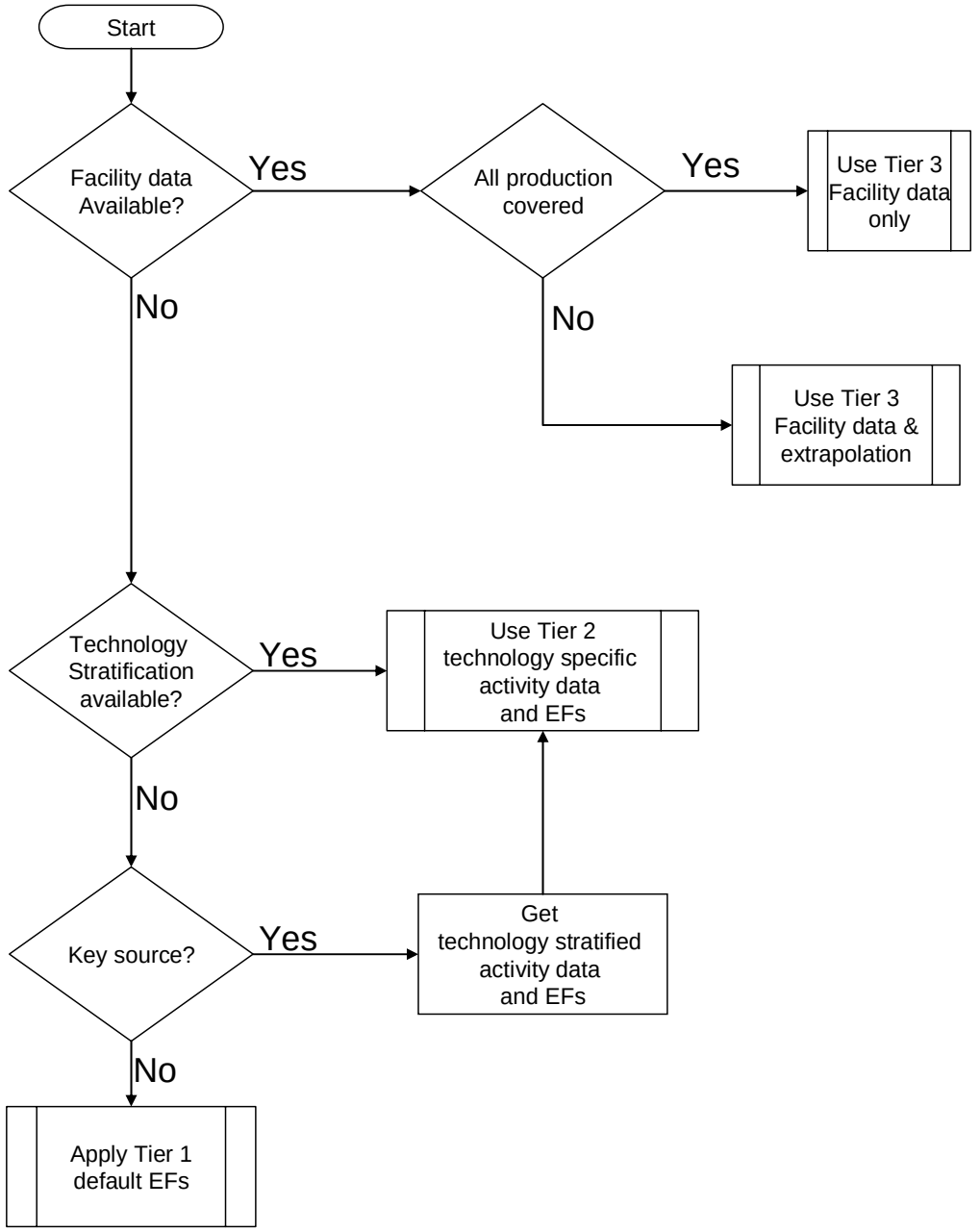
  - Tier 2: identifying different technologies

$$E_{pollutant} = \sum_{technologies} \left(AR_{production,technology} \times EF_{technology,pollutant} \right)$$

  - Tier 3: any more complex method, for example:
    - Use of facility level data
    - Emission modelling

Decision Tree

- When detailed data (Tier 3) are available: Use it!
- If a source is “key”, a Tier 2 (or Tier 3) method is required. If the relevant data are not available, they must be collected.
- If a source is not “key”, a Tier 1 method is sufficient.



Problems and shortcomings

- Complex project environment
  - Project commissioned and funded by EU
  - Guidebook is owned by UNECE (TFEIP and their Expert Panels)

- Lack of scientific knowledge for a number of emission source, mainly for less well-known pollutants, such as heavy metals and persistent organic pollutants (POPs)
  - Guidebook lists these as being “Not Estimated”: there is an emission, but we don’t know how large it is
  - In most cases however, these “Not Estimated” emissions can be assumed small

Problems and shortcomings (2)

- Use of economy-oriented source definitions (NFR)
  - Coupling to activities/technologies and emissions can be difficult
  - The level of importance of sources for emissions is not evenly distributed among source categories
  - For industrial emissions, a distinction between combustion-related and process-related emissions is required
    - In many cases this is too difficult:
      - Report pollutants that are expected to be mainly due to combustion in the combustion source category
      - Report pollutants that are expected to be mainly due to other processes in the process source category

Results

- Some indicative numbers:
  - 75 chapters
    - 8 general chapters
    - 67 technical chapters
  - 1782 pages
  - 1431 tables
  - 6336 emission factors

Tier 2 emission factors					
	Code	Name			
NFR Source Category	2.C.1	Iron and steel production			
Fuel	NA				
SNAP (if applicable)	040206	Basic oxygen furnace steel plant			
Technologies/Practices					
Region or regional conditions					
Abatement technologies					
Not applicable	Aldrin, Chlordane, Chlordecone, Dieldrin, Endrin, Heptachlor, Heptabromo-biphenyl, Mirex, Toxaphene, HCH, DDT, PCP, SCCP				
Not estimated	NMVOC, SOx, NH3, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, HCB				
Pollutant	**Value**	**Unit**	**95%confidence interval**		**Reference**
			Lower	**Upper**	
NOx	10	g/Mg steel produced	5	20	European Commission (2001)
CO	3.5	kg/Mg steel produced	1.5	8	European Commission (2001)
TSP	35	g/Mg steel produced	15	80	European Commission (2001)
PM10	32	g/Mg steel produced	14	76	Visschedijk et al. (2004) applied on TSP
PM2.5	28	g/Mg steel produced	12	72	Visschedijk et al. (2004) applied on TSP
Pb	4	g/Mg steel produced	2.7	6.7	Theloke et al. (2008)
Cd	0.067	g/Mg steel produced	0.053	0.08	Theloke et al. (2008)
Hg	0.0014	g/Mg steel produced	0.0007	0.0021	Theloke et al. (2008)
As	0.4	g/Mg steel produced	0.27	0.53	Theloke et al. (2008)
Cr	2.3	g/Mg steel produced	1.5	3.1	Theloke et al. (2008)
Cu	0.02	g/Mg steel produced	0.01	0.04	European Commission (2001)
Ni	0.13	g/Mg steel produced	0.067	0.67	Theloke et al. (2008)
Se	0.003	g/Mg steel produced	0.0003	0.03	Guidebook (2006)
Zn	4	g/Mg steel produced	0.4	40	Guidebook (2006)
PCB	3.6	mg/Mg steel produced	2	5	Guidebook (2006)
PCDD/F	0.00775	µg I-TEQ/Mg steel	0.001	0.06	European Commission (2001)
Total 4 PAHs	0.1	mg/Mg steel produced	0.08	0.16	European Commission (2001)

- Emission factor database
  - Database contains all emission factors and their properties
  - Can be used for quick lookup of emission factors
  - Simplifies the process of future updates

Application of the revised Guidebook

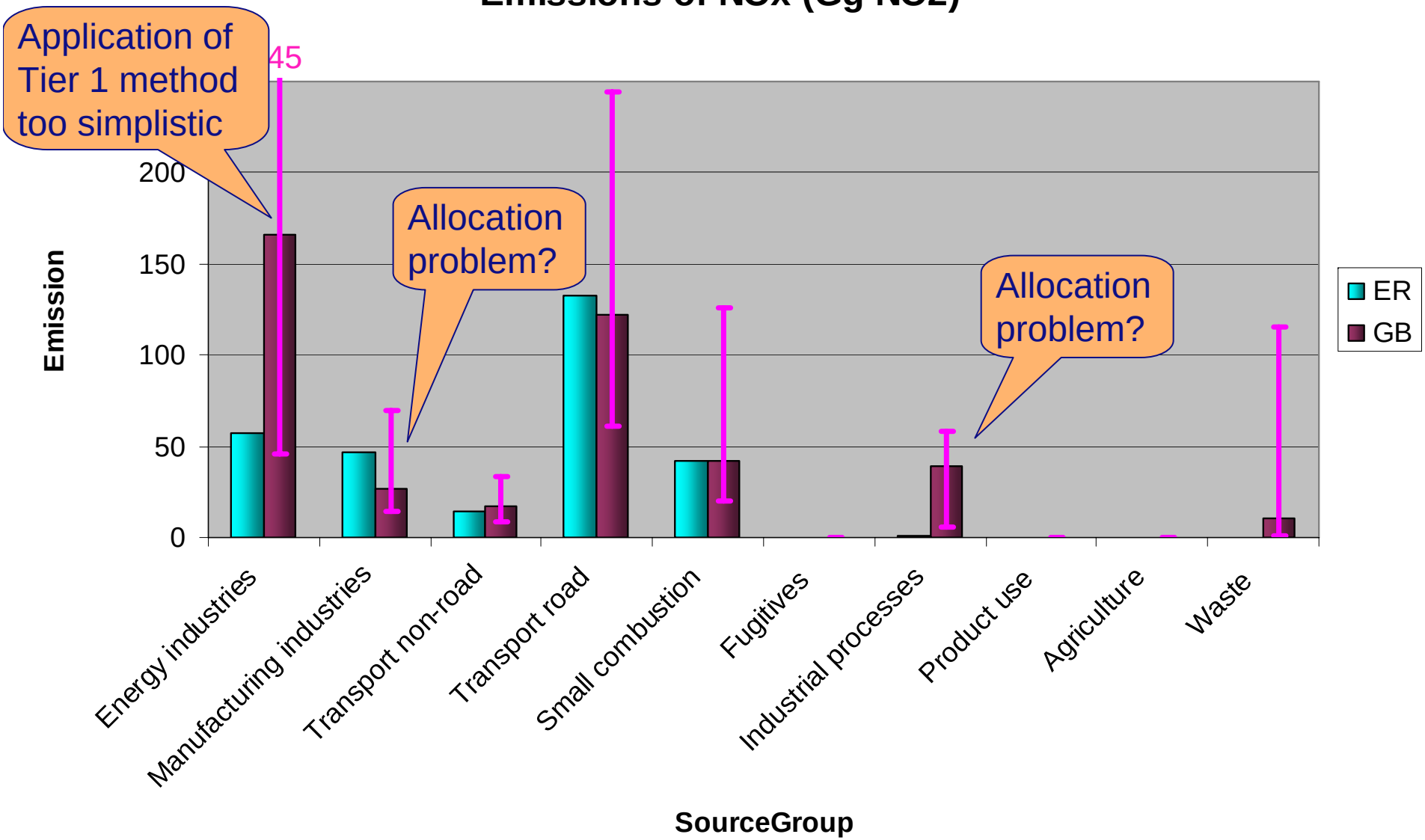
- A comparison between the Dutch Emission Registry and an inventory creased using the Guidebook, for air pollutants only
- Results from the simple methods in the Guidebook are compared to the complex methods used in the Dutch emission inventory system for the year 2005
- The purpose of this study is to look for observed differences and similarities, and if we can explain them
  - It is difficult to say whether one of the two is right or wrong, since both inventories still contain uncertainties

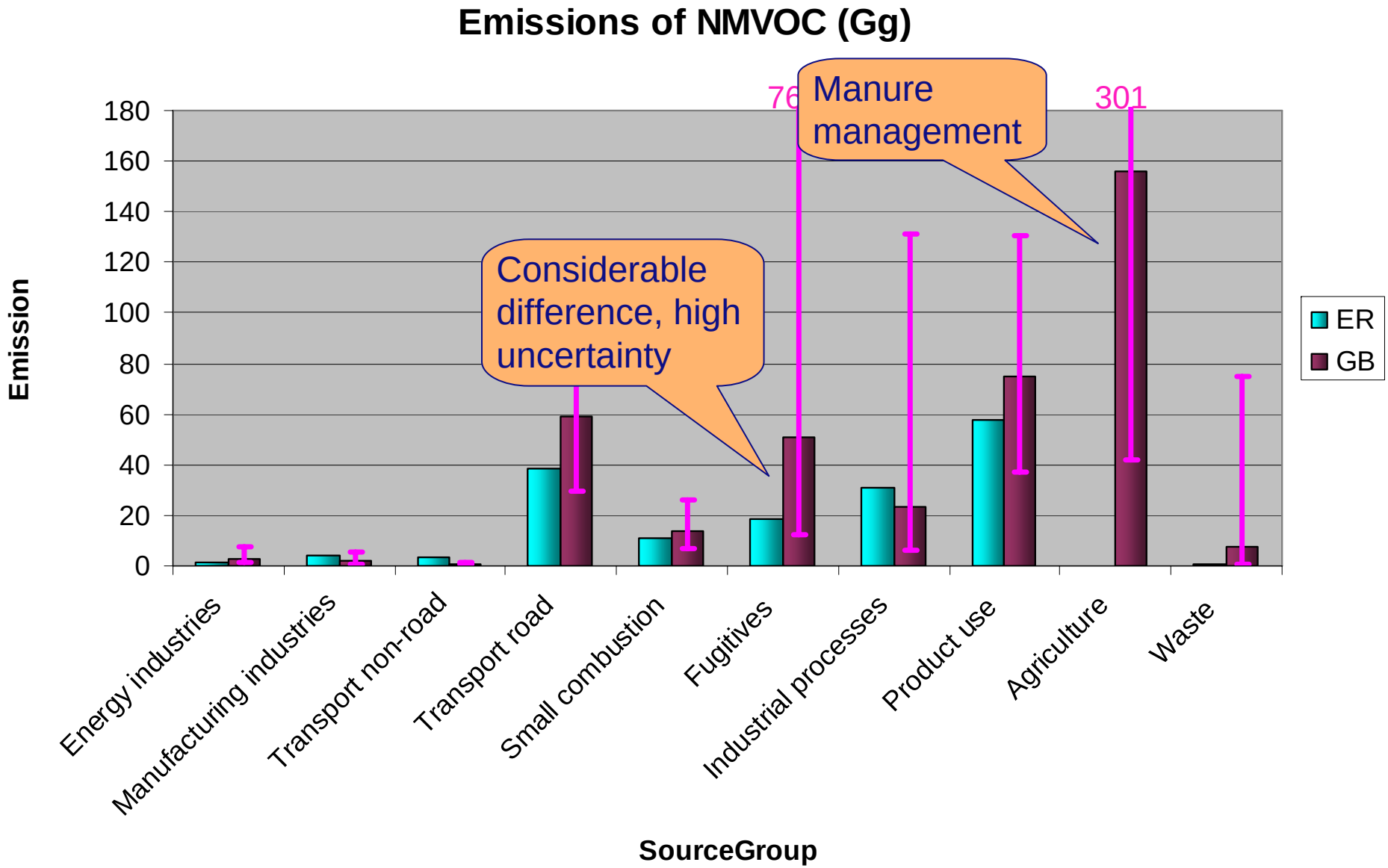
Comparison

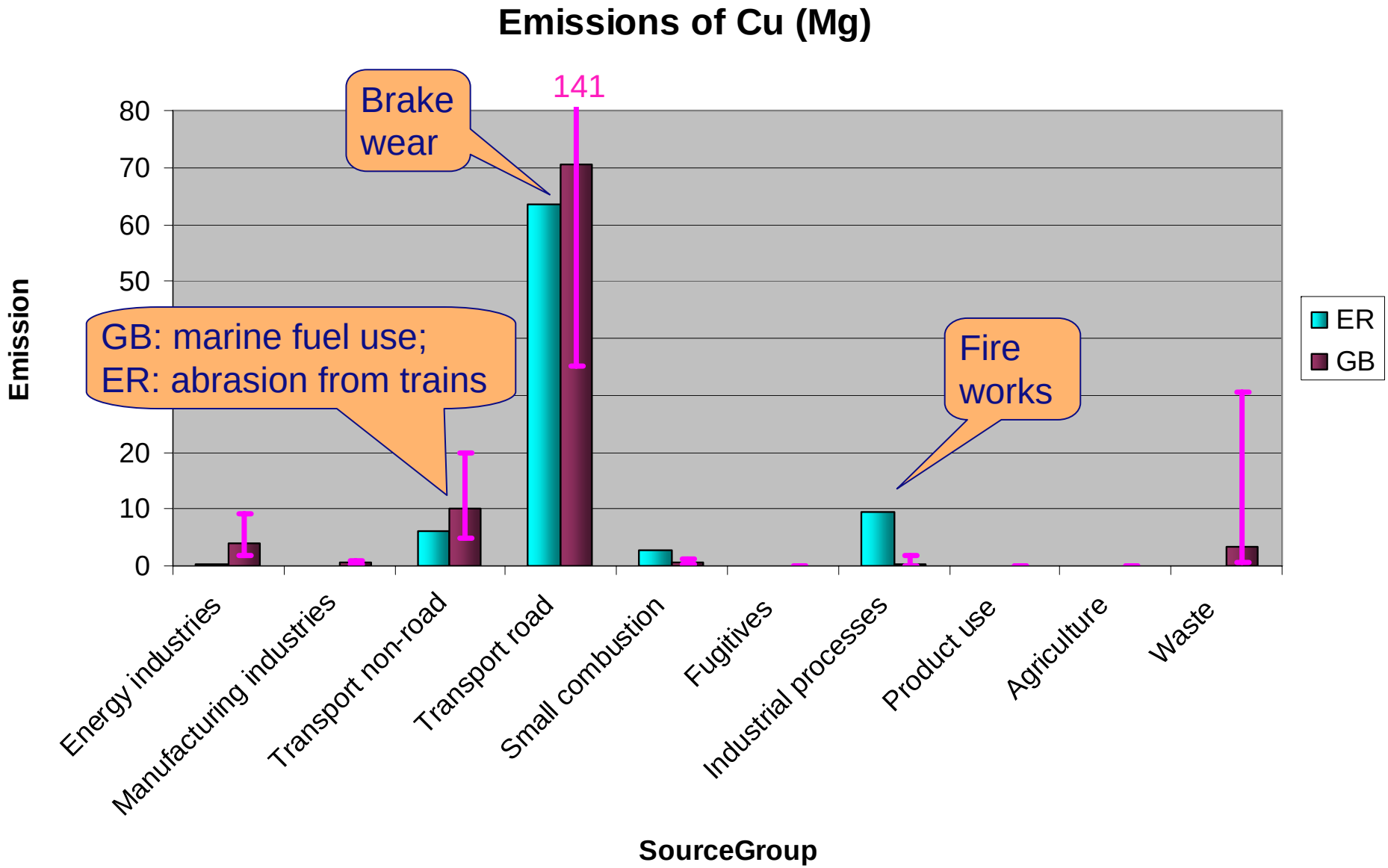
- Guidebook emissions calculated by combining emission factors with relevant activity statistics
  - Activity statistics collected from various sources, including:
    - IEA Energy Statistics
    - Production data from industrial organisations (USGS, FAO)
    - Netherlands Statistics (CBS)

- Comparison between the Dutch Emission Inventory and the Guidebook works, because after the revision both use the same source definitions

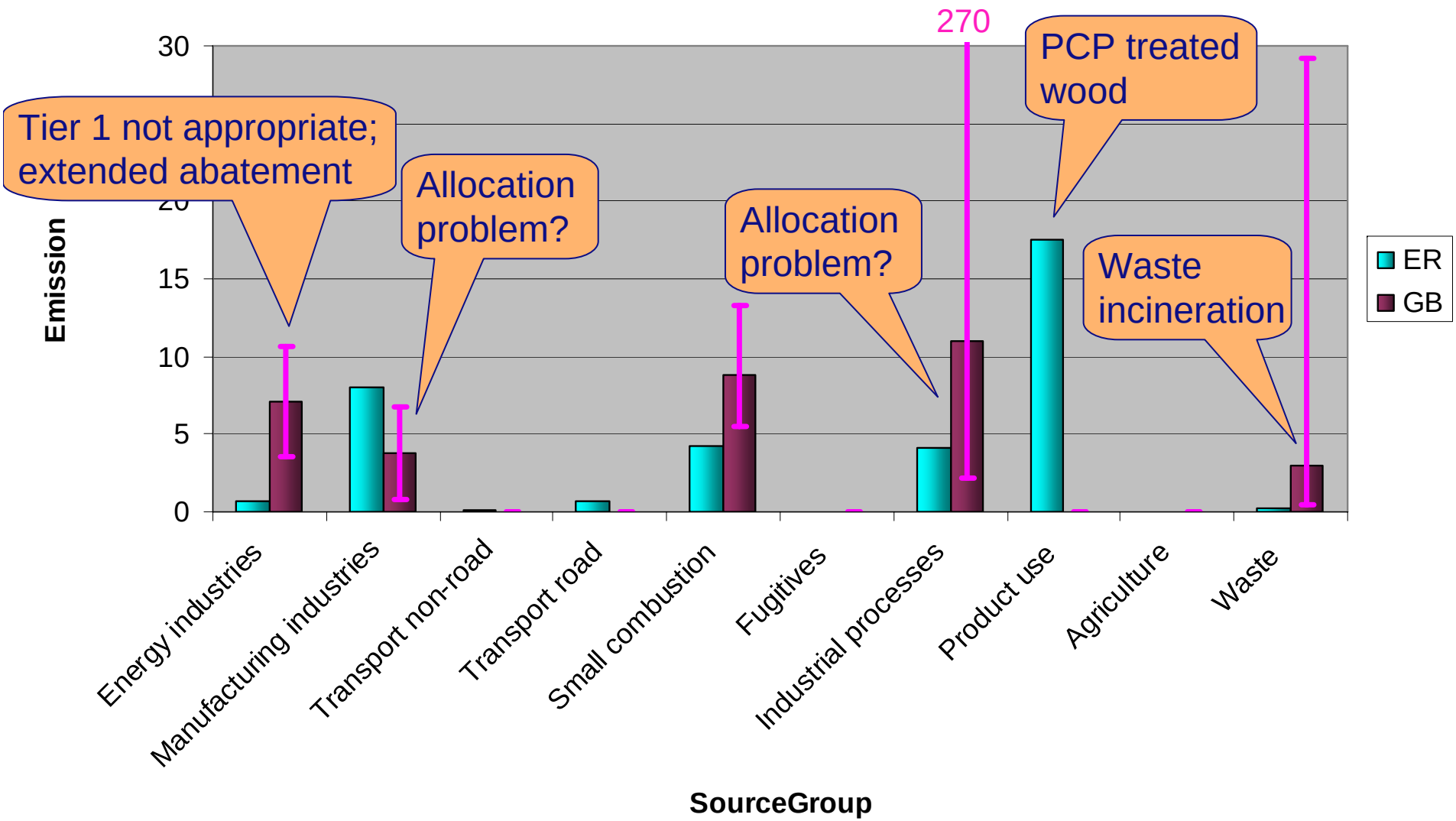
Emissions of NOx (Gg NO2)




Emissions of NMVOC (Gg)
Emission
180
160
140
120
100
80
60
40
20
0
76
301
Manure management
Considerable difference, high uncertainty
ER
GB
Energy industries
Manufacturing industries
Transport non-road
Transport road
Small combustion
Fugitives
Industrial processes
Product use
Agriculture
Waste
SourceGroup


Emissions of Cu (Mg)
Brake wear
141
GB: marine fuel use;
ER: abrasion from trains
Fire works
Emission
80
70
60
50
20
10
0
ER
GB
Energy industries
Manufacturing industries
Transport non-road
Transport road
Small combustion
Fugitives
Industrial processes
Product use
Agriculture
Waste
SourceGroup

Emissions of PCDD/F (g I-TEQ)



Comparison Dutch ER and Guidebook

- In the Energy generation sector, the Dutch Emission Registry has lower emissions compared to the calculated Guidebook emissions for every pollutant
  - This is likely to be due to the extended level of abatement installed in the Netherlands in order to reduce hazardous emissions from power plants

- For the well-known pollutants (NOx, SO2, NMVOCs):
  - the calculated emissions using the Guidebook exceed those in the Dutch Emission Registry

- For less well-known pollutants, such as heavy metals and persistent organic pollutants (POPs):
  - Differences not so pronounced
  - Missing sources ?

Overall conclusions

- The revised Guidebook
  - Better for application in reporting requirements for countries
  - Complete and transparent
  - Can be used to compare a Guidebook inventory to a national inventory, such as for the Netherlands
  - Still problems exist, missing EFs, missing sources, etc.

- Comparison to national inventory
  - Shows how the country performs compared to “average”
  - Identifies possible errors/problems in the inventory and/or the Guidebook
  - Can identify missing sources in the inventory and Guidebook

Acknowledgement

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Thank you for your attention