

# Air Quality Governance in the ENPI East Countries

## *RPP3 – Training workshop*

### Mobile combustion

14-16 July, 2014, Chişinău, Moldova



MWH



Center for Environmental and Nuclear Safety



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# Outline

- Scope of the model
- Input data
  - Road transport
  - Other mobile sources
- Emission factors and emission types
  - Road transport
  - Other mobile sources
- Emission output
  - Road transport
  - Other mobile sources

# Scope of the model

- Pollutants:
  - NO<sub>x</sub>, SO<sub>x</sub>, CO and PM (TSP, PM<sub>10</sub> and PM<sub>2.5</sub>)
- Sectors:
  - Road transport
  - Other mobile sources
    - Non-road machinery
    - Maritime activities
    - Railways
    - Aviation
- Geographical coverage:
  - The cities as chosen by the participating countries

# Scope of the model

- For mobile sources in this project, focus has been on road transport, as it is the most important mobile emission source
- A model is set up which use the detailed vehicle fleet structure and the basis emission factor data from the well established emission model COPERT IV
- For flexibility, user friendliness and in order to serve spatial mapping, the actual COPERT IV software is not used in this project

# Input data

## Road transport

- The most detailed available fleet and mileage numbers for each city
- If sufficient detail is not available combined with default fleet/mileage distribution keys
- City-specific ambient temperatures
- Fuel sulphur content

# Input data

## Fleet characterisation

- Vehicle categories: Cars, vans, trucks, buses, mopeds and motorcycles
- Vehicle categories grouped into sub-classes (fuel type, engine size, weight)
- Layers: Sub-classes further split into Euro levels (EU emission legislation) for which emission factors exist

# Vehicle sub classes in the model

Vehicle classes	Fuel type	Engine size/weight	km/h
Urban buses	Gasoline		30
	CNG		30
	LPG		30
	Diesel	< 15 tonnes	30
	Diesel	15-18 tonnes	30
	Diesel	> 18 tonnes	30
Coaches	Gasoline		35
	CNG		35
	LPG		35
	Diesel	< 15 tonnes	35
	Diesel	15-18 tonnes	35
	Diesel	> 18 tonnes	35
Mopeds	Gasoline		30
Motorcycles	Gasoline	2 stroke	40
	Gasoline	< 250 cc.	40
	Gasoline	250 – 750 cc.	40
	Gasoline	> 750 cc.	40

Vehicle classes	Fuel type	Engine size/weight	km/h
Passenger Cars	Gasoline	< 1.4 l.	40
	Gasoline	1.4 – 2 l.	40
	Gasoline	> 2 l.	40
	Diesel	< 2 l.	40
	Diesel	> 2 l.	40
	LPG		40
	CNG		40
	2-stroke		40
	Vans	Gasoline	
Diesel			40
CNG			40
LPG			40
Trucks	Gasoline		35
	CNG		35
	LPG		35
	Diesel	Rigid 3,5 - 7,5t	35
	Diesel	Rigid 7,5 - 12t	35
	Diesel	Rigid 12 - 14 t	35
	Diesel	Rigid 14 - 20t	35
	Diesel	Rigid 20 - 26t	35
	Diesel	Rigid 26 - 28t	35
	Diesel	Rigid 28 - 32t	35
	Diesel	Rigid >32t	35
	Diesel	TT/AT 14 - 20t	35
	Diesel	TT/AT 20 - 28t	35
	Diesel	TT/AT 28 - 34t	35
Diesel	TT/AT 34 - 40t	35	
Diesel	TT/AT 40 - 50t	35	
Diesel	TT/AT 50 - 60t	35	
Diesel	TT/AT >60t	35	

- **Additional fleet layers in the model**
- **Emission factors at this level**

<b>Vehicle category</b>	<b>Euro levels</b>	<b>Vehicle 1 reg. Date</b>
<b>Passenger cars, all fuels, engine sizes</b>	<b>Pre ECE</b>	
	<b>ECE 15/00-01</b>	<b>1972<sup>a</sup></b>
	<b>ECE 15/02</b>	<b>1981<sup>b</sup></b>
	<b>ECE 15/03</b>	<b>1982<sup>c</sup></b>
	<b>ECE 15/04</b>	<b>1987<sup>d</sup></b>
	<b>Euro I</b>	<b>1.10.1990<sup>e</sup></b>
	<b>Euro II</b>	<b>1.1.1997</b>
	<b>Euro III</b>	<b>1.1.2001</b>
	<b>Euro IV</b>	<b>1.1.2006</b>
	<b>Euro V</b>	<b>1.1.2011</b>
	<b>Euro VI</b>	<b>1.9.2015</b>
<b>Vans, all fuels</b>	<b>Conventional</b>	
	<b>Euro I</b>	<b>1.10.1994</b>
	<b>Euro II</b>	<b>1.10.1998</b>
	<b>Euro III</b>	<b>1.1.2002</b>
	<b>Euro IV</b>	<b>1.1.2007</b>
	<b>Euro V</b>	<b>1.1.2012</b>
	<b>Euro VI</b>	<b>1.9.2016</b>

- **For diesel cars, Euro levels before Euro I are represented by one category “conventional”**
- **For LPG and CNG cars, Euro levels before Euro I are grouped in “conventional & retrofit”**

<b>Vehicle category</b>	<b>Euro levels</b>	<b>Vehicle 1 reg. Date</b>
<b>Trucks and buses (all fuels)</b>	<b>Conventional</b>	
<b>Diesel, LPG, CNG (all sizes)</b>	<b>Euro I</b>	<b>1.10.1993</b>
	<b>Euro II</b>	<b>1.10.1996</b>
	<b>Euro III</b>	<b>1.10.2001</b>
	<b>Euro IV</b>	<b>1.10.2006</b>
	<b>Euro V</b>	<b>1.10.2009</b>
	<b>Euro VI (diesel)</b>	<b>1.10.2014</b>
	<b>EEV (CNG/LPG)</b>	<b>-</b>
<b>Mopeds, 2-stroke</b>	<b>Conventional</b>	
	<b>Euro I</b>	<b>2000</b>
	<b>Euro II</b>	<b>2004</b>
<b>Mopeds, 4-stroke</b>	<b>Euro I</b>	<b>2000</b>
	<b>Euro II</b>	<b>2004</b>
	<b>Euro III</b>	<b>2015</b>
<b>Motor cycles</b>	<b>Conventional</b>	
<b>All sizes</b>	<b>Euro I</b>	<b>2000</b>
	<b>Euro II</b>	<b>2004</b>
	<b>Euro III</b>	<b>2007</b>

# Input data

## Other mobile sources

- For other mobile sources the required input data are fuel consumption data and for non-road machinery a technology split for gasoline machinery
- Non-road machinery:
  - Consumption of diesel, gasoline (divided into 2-stroke and 4-stroke engines) and LPG in tonnes
  - Sulphur content if available
- Railways:
  - Diesel consumption in tonnes
  - Sulphur content if available

# Input data

## Other mobile sources

- Maritime activities:
  - Consumption of marine diesel, gasoline and heavy fuel oil in tonnes
  - Sulphur content if available
- Aviation:
  - Number of domestic and international landings and take-offs (LTOs)

# Emission factors

## Road transport

- Fuel consumption and emission factors (g/km) for hot engines are derived from COPERT IV (per layer)
- Pollutants:  $\text{NO}_x$ ,  $\text{SO}_2$ , CO and PM (TSP,  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$ )
- The emission impacts of catalyst wear and cold start are also taken into account
- Emissions of PM from non-exhaust (i.e. tyre/brake wear and road abrasion) are also included in the model

# Emission factors

## Other mobile sources

- The emission factors from the EMEP/EEA Guidebook is used as default values
- The emission factors available in the EMEP/EEA Guidebook is expressed in the same activity data unit as the data input, so no conversion is necessary
- If country-specific or city-specific emission factors are available the default emission factors from the EMEP/EEA Guidebook can simply be replaced in the model

# Emission output

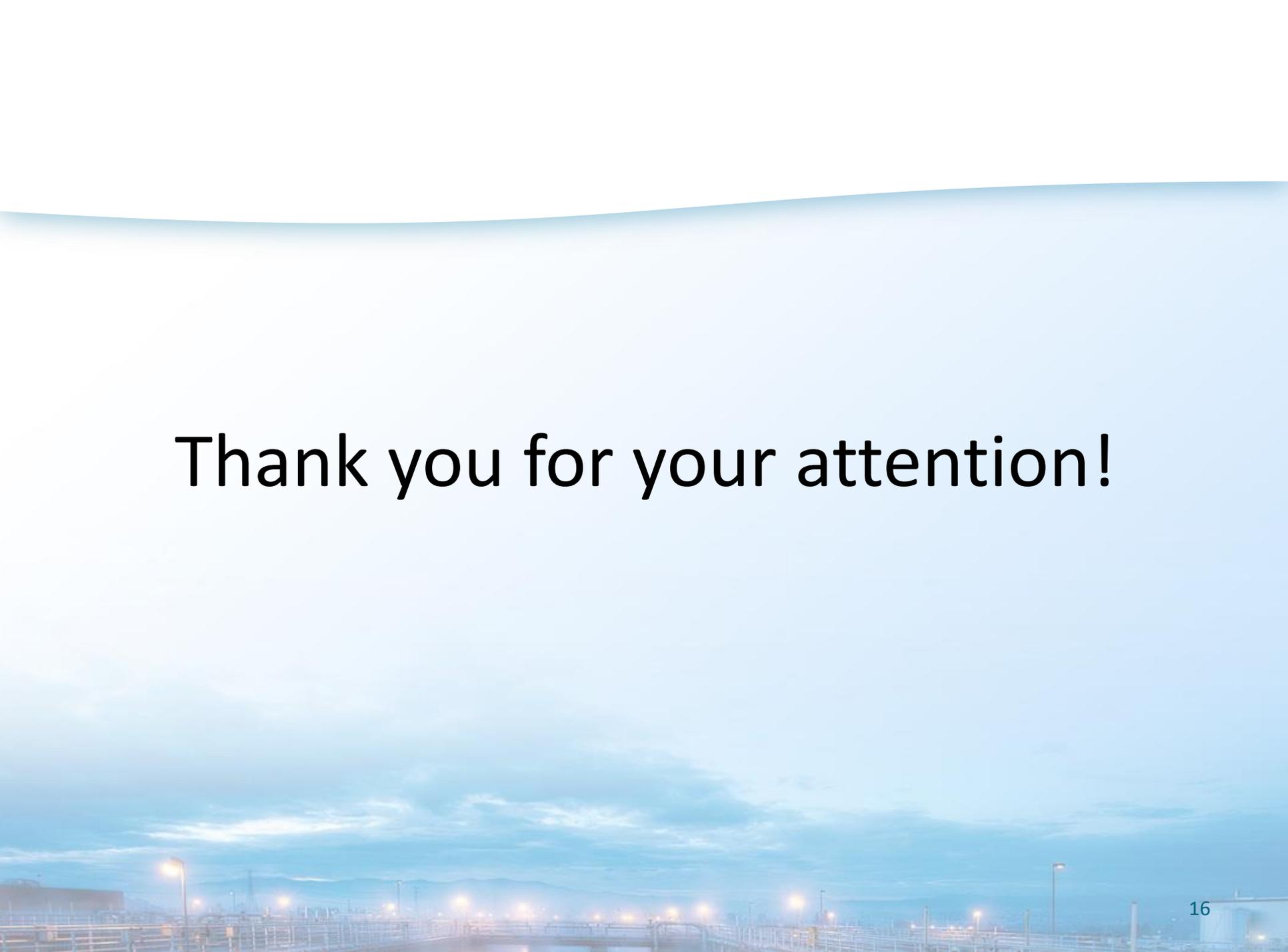
## Road transport

- The calculations of road transport emissions take place in a MS Access database
- From the database, the estimated emissions of  $\text{NO}_x$ ,  $\text{SO}_x$ , CO and PM (TSP,  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$ ) are exported to MS Excel where they serve as input to the spatial distribution

# Emission output

## Other mobile sources

- The emissions are calculated in a spreadsheet model combining the input data and the emission factors
- The output is divided in parts covering the different activities (non-road machinery, maritime activities, railways and aviation). For all activities the output contains:
  - The estimated emissions of  $\text{NO}_x$ ,  $\text{SO}_x$ , CO and PM (TSP,  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$ )
  - The sector code (SNAP) used in the spatial distribution and the air quality modelling



**Thank you for your attention!**