Risk Habitat Megacity

Air Quality and Health

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Content

Air Quality
& Health

1. *Problem Analysis – What are the risks?*
2. *Methodological Approach*
3. *Insights on the Development of Traffic Emissions*
4. *Results*

Research questions

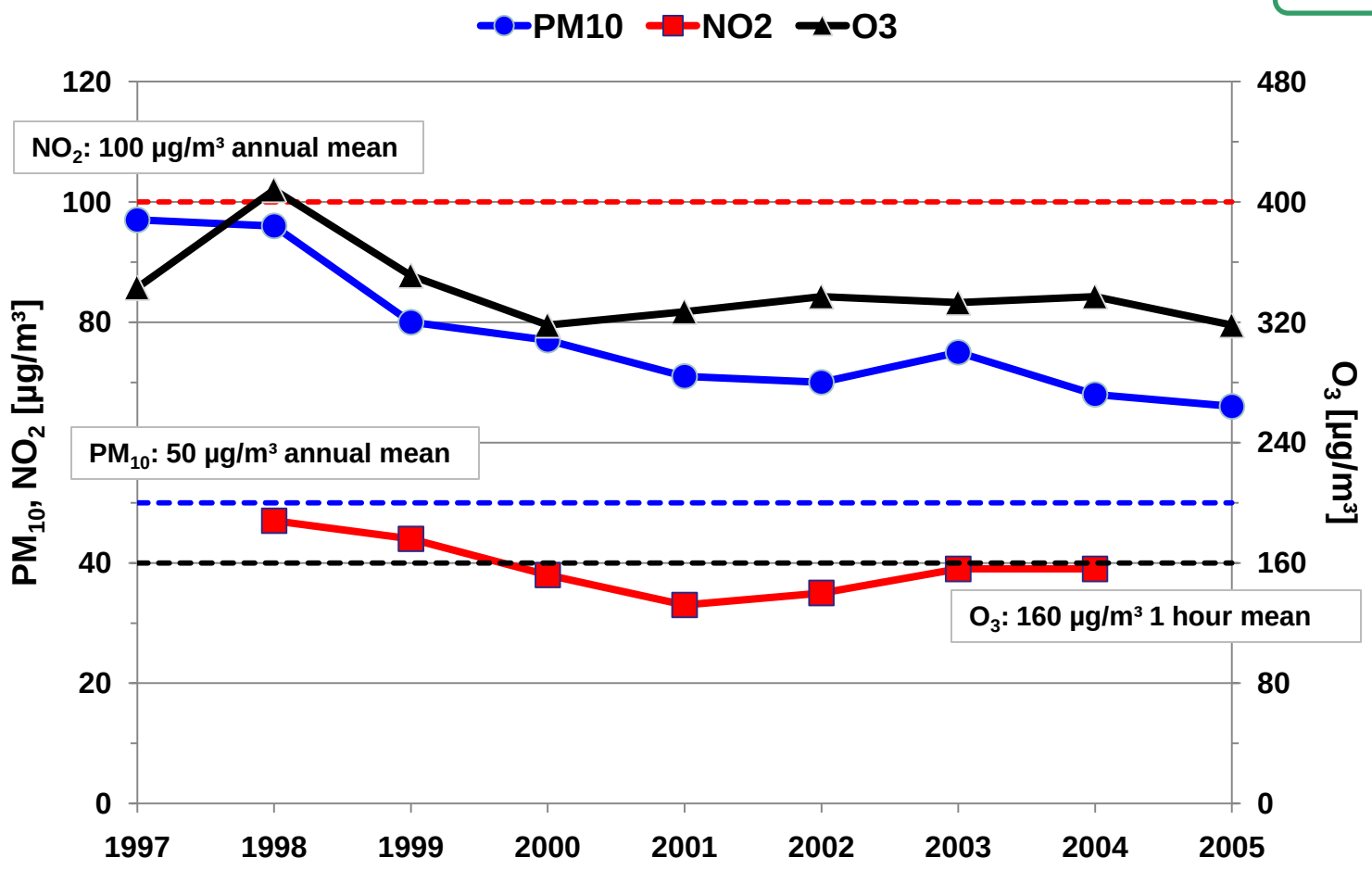
Air Quality & Health

- Do we understand the **complex links** between emissions, air quality and health impact? **Where and what is at risk in this chain?**
- How can suitable **emission inventories** for reliable air quality assessment studies be developed? **What is the part of the traffic?**
- How can separate **information platforms** be linked to the development of an integrated approach to air quality assessment in megacities? **What are the indicators to define the risk?**
- Which relationship exists between specific air pollutants like PM_{10} or NO_2 and the **appearance of environment-related diseases**? **What are the risk levels?**

Status analysis of the risks on air pollution

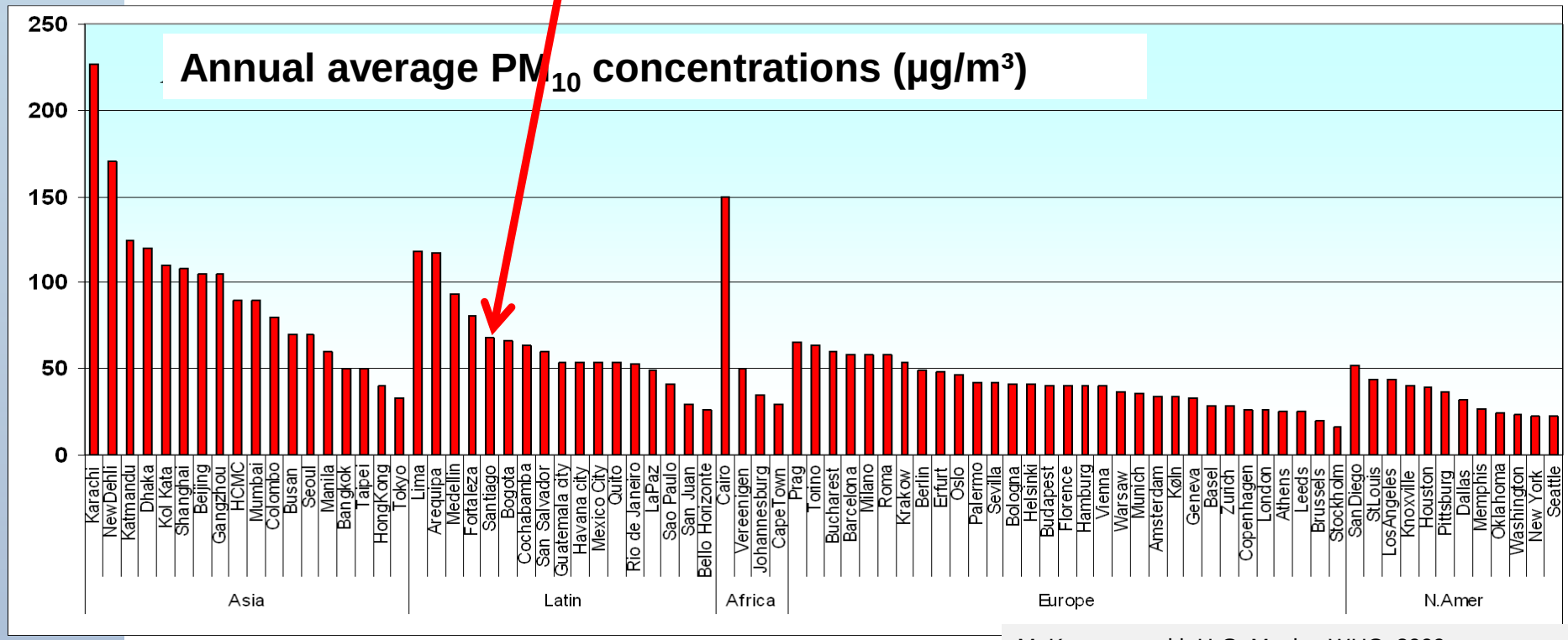
Air Quality & Health

Air Pollution



Source: CONAMA

Status analysis of the risks on air pollution



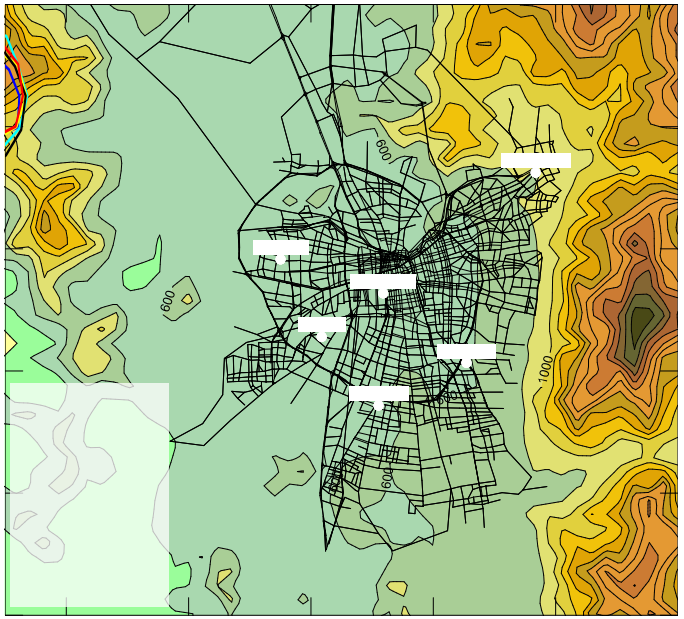
M. Krzyzanowski, H-G. Mucke, WHO, 2009

Comparison of Megacites

Status analysis of the risks on air pollution

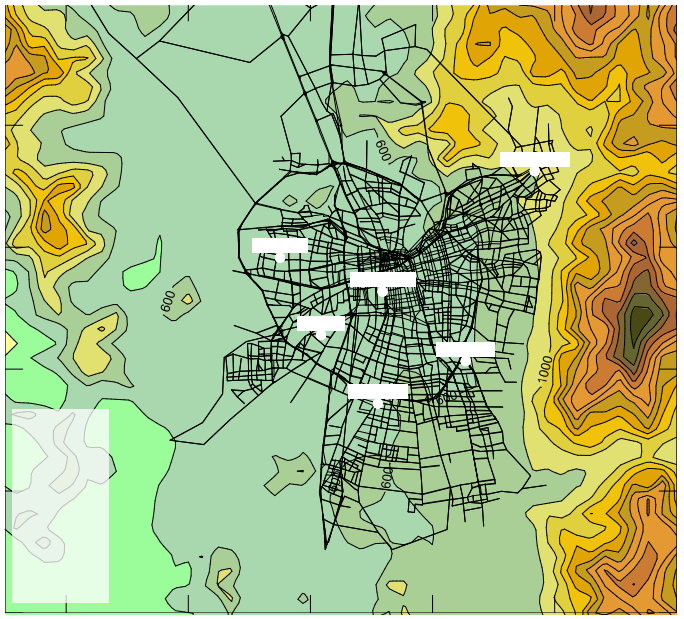
Air Quality & Health

Air Pollution



2004	Pudad-huel	La Florida	Parque O'Higgins	Las Condes	Cerrillos	El Bosque
Mean	67.1	80.7	67.9	52.5	67.9	77.1
95 %	164.0	203.0	162.0	115.0	166.0	185.0

PM_{10}



2004	Pudad-huel	La Florida	Parque O'Higgins	Las Condes	Cerrillos	El Bosque
Mean	16.5	17.3	15.6	20.6	15.9	19.0
95 %	50.4	58.2	56.3	74.4	51.5	51.8

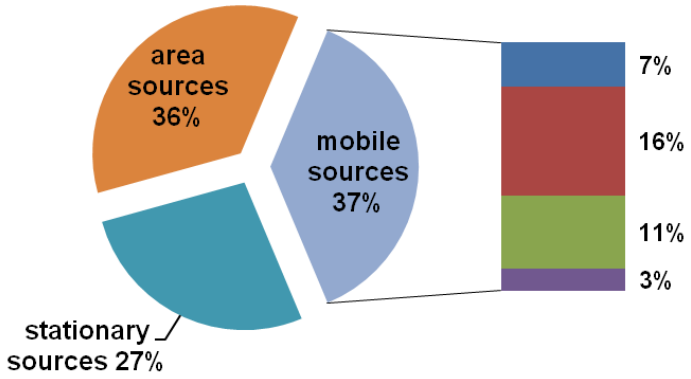
O_3

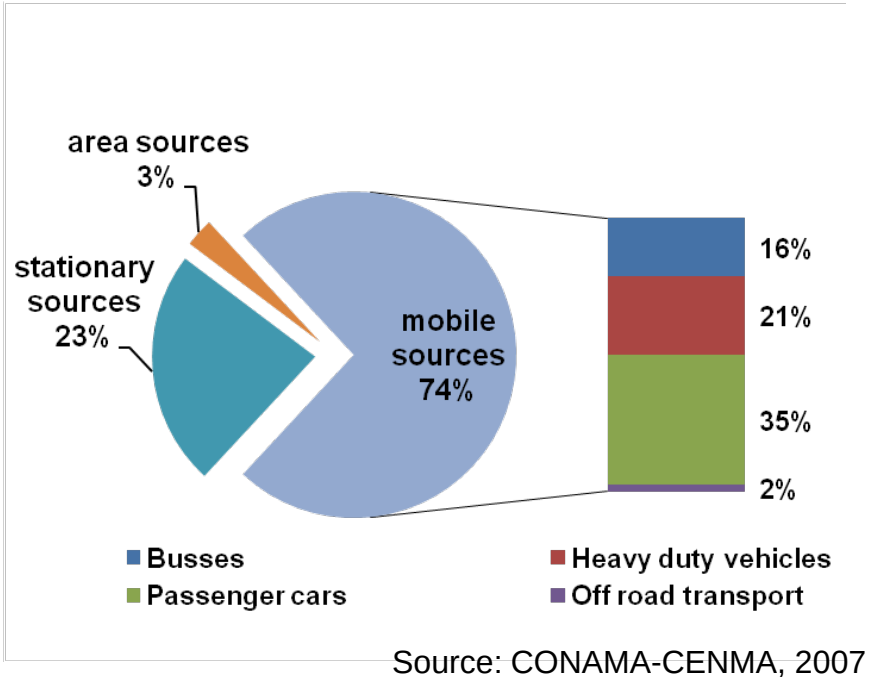
Source: CONAMA-Database

Status analysis of the risks on air pollution

Air Quality & Health

Emission Sources





Source: CONAMA-CENMA, 2007

PM_{10}

NOx

Status analysis of the risks on air pollution

Air Quality & Health

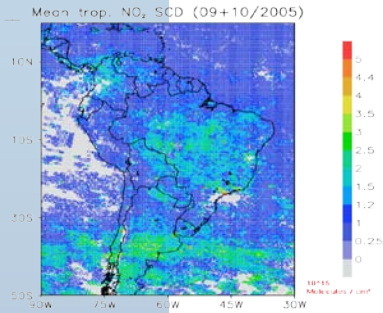
Up to date emission inventory (April 2010) for NO

Area Emissions

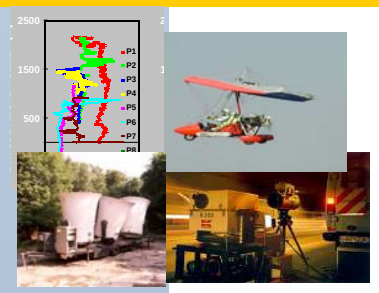
Mobile Emissions

Methodological Approach

Satellite Data



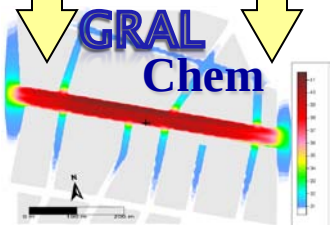
Measurement Data

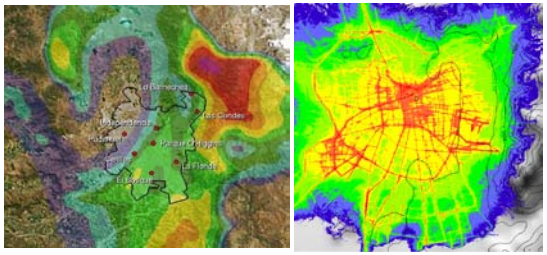


Traffic Data

WRF Chem

GRAL Chem





Air Quality

Scenarios

Air Pollutants - Mortality rates

Indicators

Mortality

Elements at Risk

Health Impact

Stakeholder

Results: Micro Scale - Traffic Emissions

Air Quality & Health

Cooperation with FoA **Transportation**

ESTRAUS
- total vehicle flow
- street network

Emission factors
- experimental results

Vehicular disaggregation
- fleet composition

Temporal disaggregation
- Driving profiles

Annual Emissions

Hourly Emissions

Simulation of traffic emissions

$$E_{ijk}[g] = TF_j[veh/h] * L_j[km] * VD_{jk} * TF_{jk} * EF[g/km]_{ik}$$

Results: Micro Scale - Traffic Emissions

Air Quality & Health

61 vehicle categories

Buses licitados Diesel convencional
Buses licitados Diesel tipo 1
Buses licitados Diesel tipo 2
Buses licitados Diesel tipo 3
Buses licitados DIesel tipo 3 Articulando
Buses licitados Diesel tipo 2 con filtro
Buses licitados Diesel tipo 3 con filtro
Buses Interurbanos Diesel convencional
Buses Interurbanos Diesel tipo 1
Buses Alimentador Diesel tipo 2
Buses Alimentador Diesel tipo 3
Buses Alimentador Diesel tipo 3 con filtro
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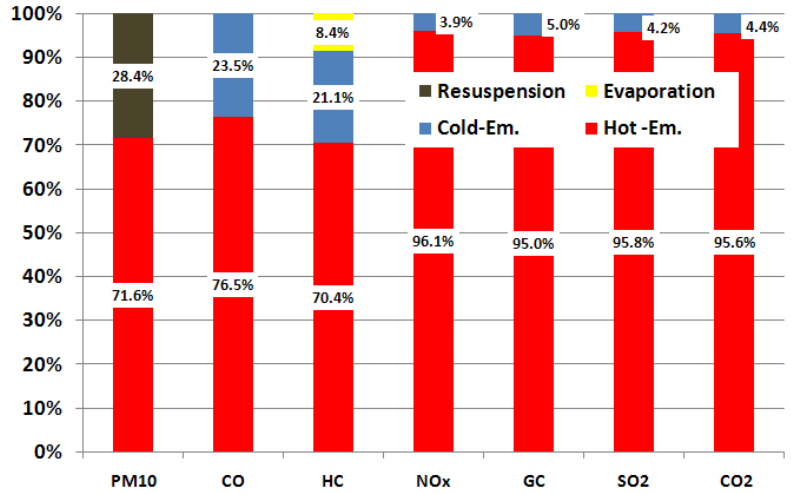


Input data for the simulation of traffic emissions

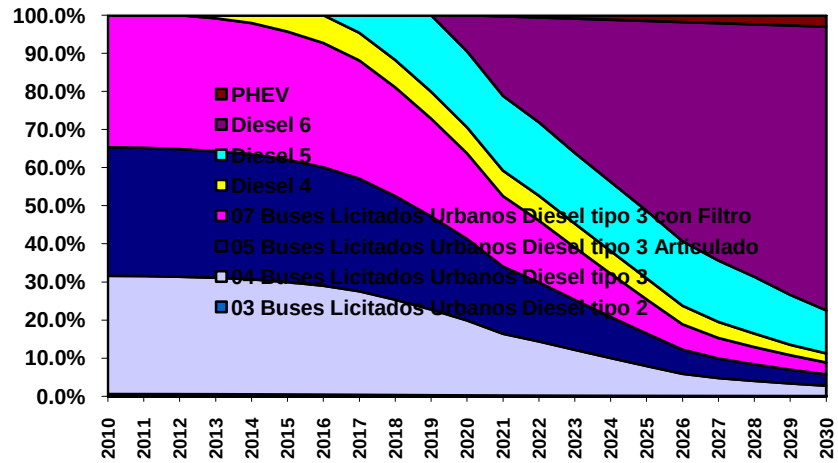
5 categories of emissions

cold emissions
hot emissions
evaporation
resuspension (→ abrasion tyres, abrasion brakes)

6 emission pollutants

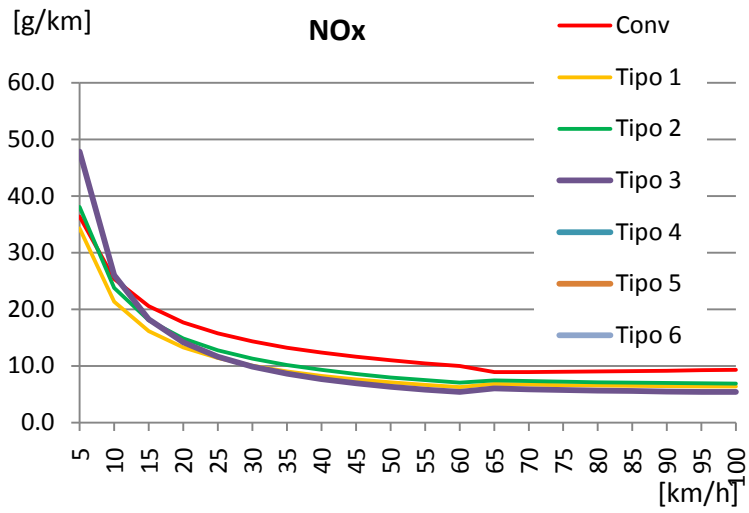
PM10
SO2
NOx
HC
CO
CO2
[Gasoline consumption]

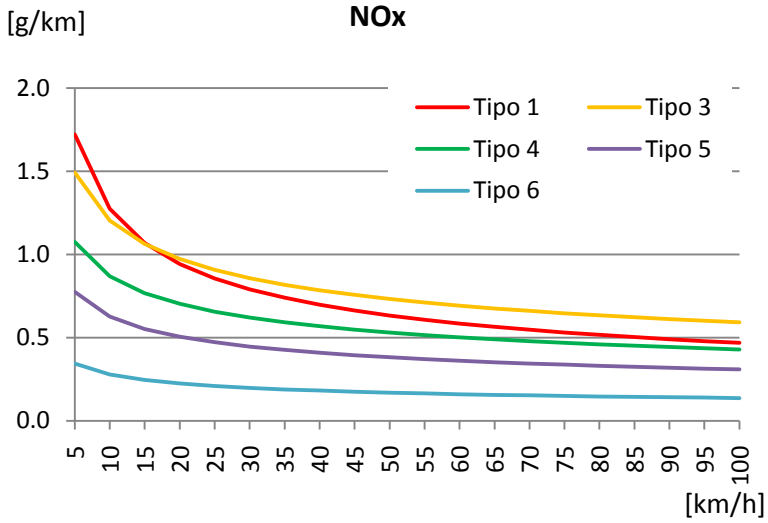
3 scenarios

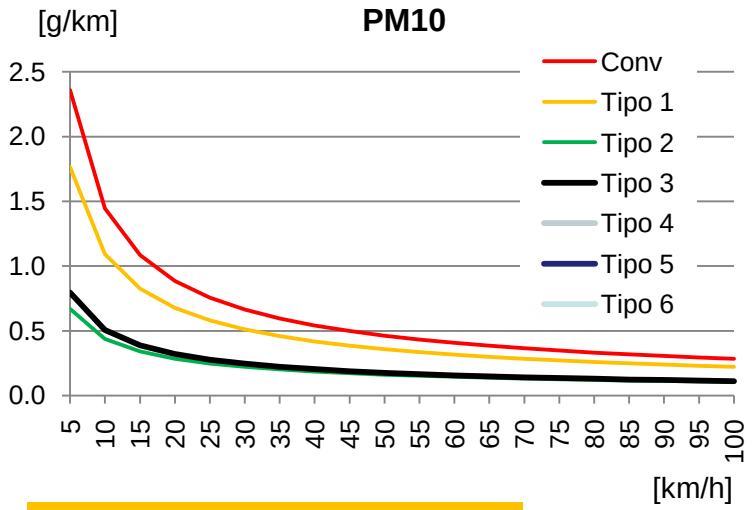


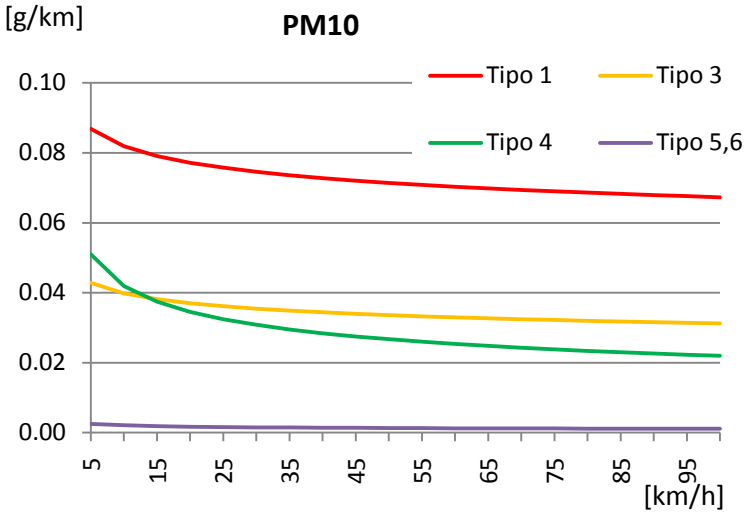
Results: Micro Scale - Traffic Emissions

Air Quality & Health







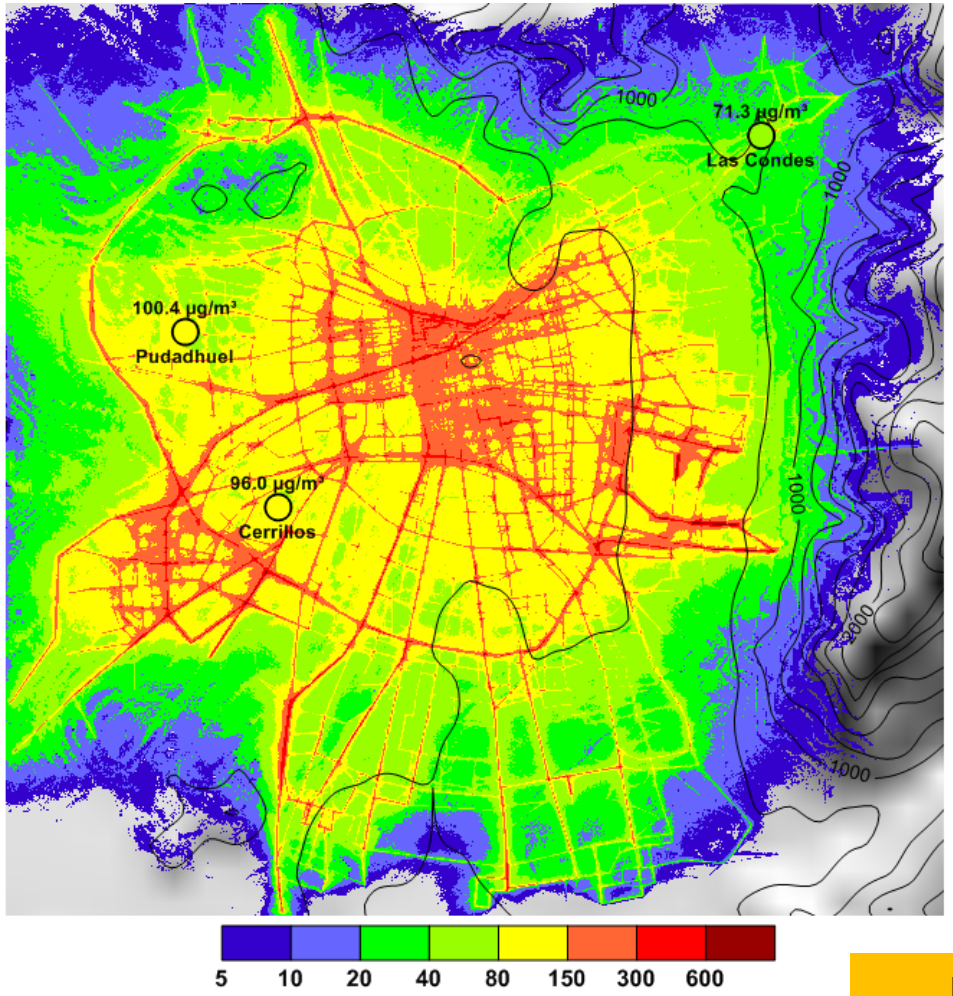


Busses

Passenger Cars

Results: Micro Scale - Traffic Emissions

Air Quality
& Health

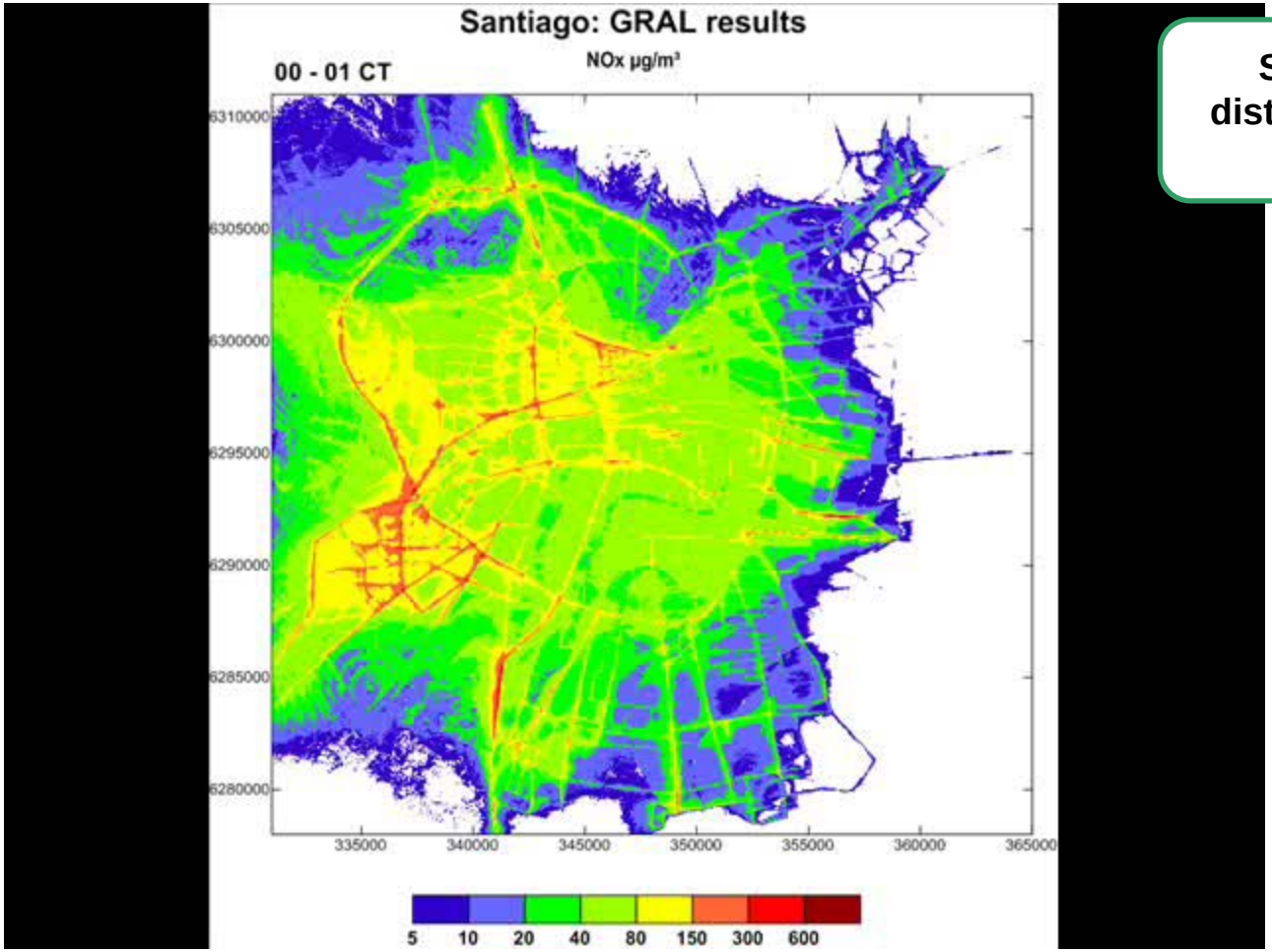


Simulated NOx distribution of traffic emissions

NOx in µg/m³

Results: Micro Scale - Traffic Emissions

Air Quality
& Health



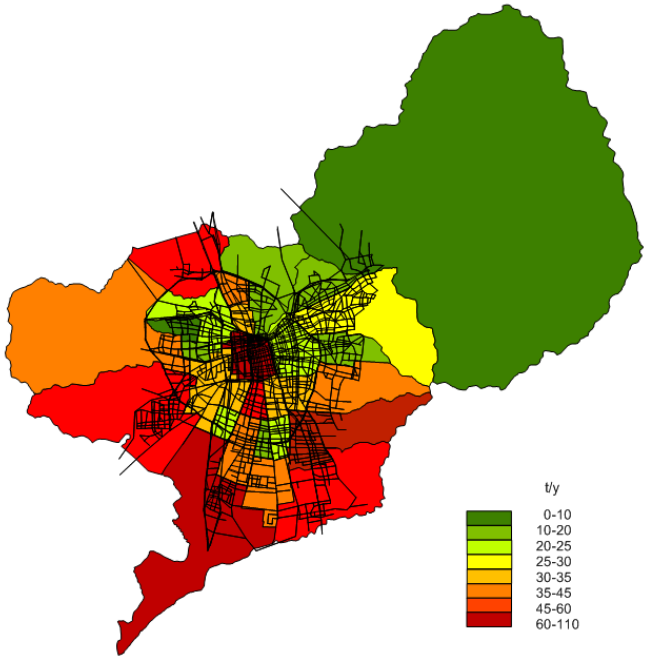
Simulated NOx distribution of traffic emissions

NOx in µg/m³

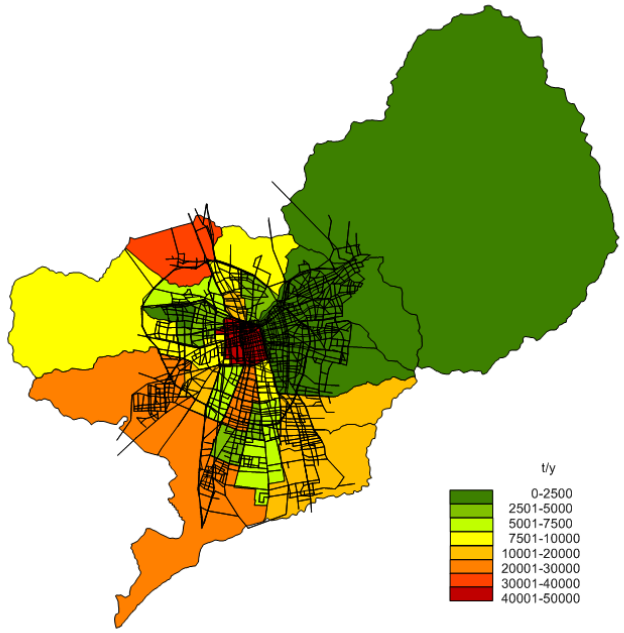
Results: Traffic Emissions

Air Quality & Health

Traffic Emissions and Comunas

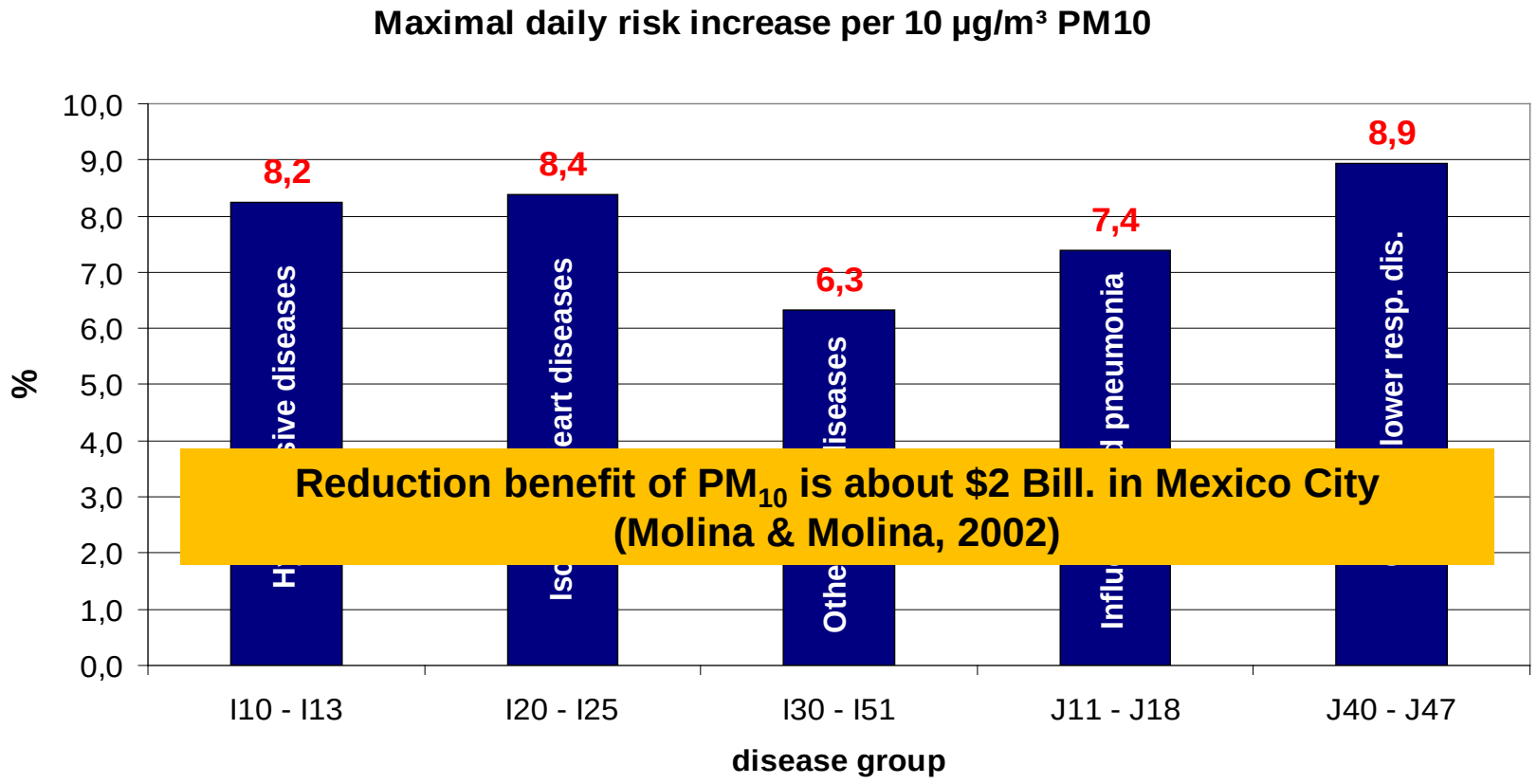


PM_{10}



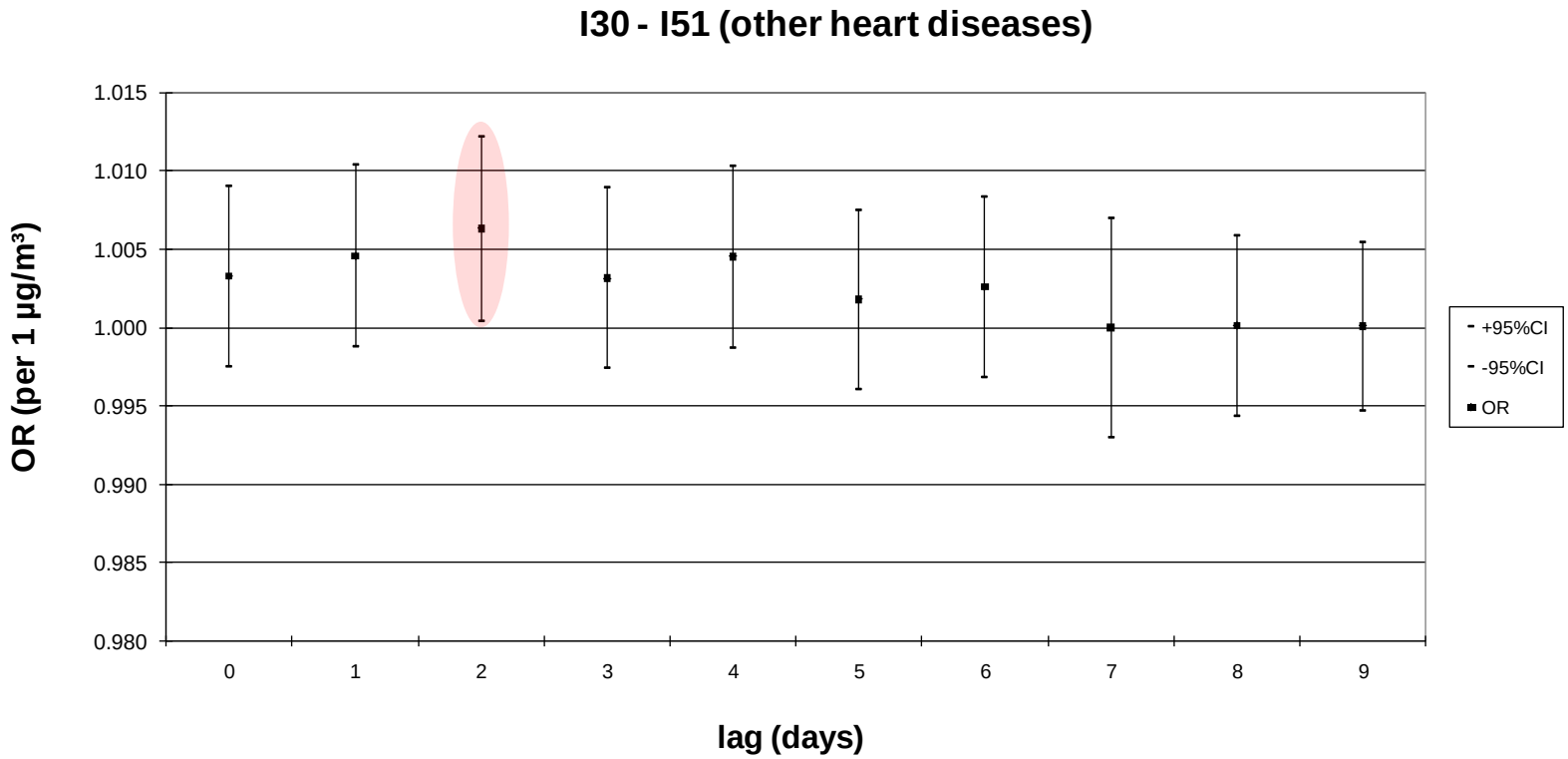
NOx

Results: Health Impact



Maximum Mortality Risks (OR) per 10 µg/m³ PM_{10}

Results: Health Impact



Maximum Mortality Risks (OR) per 1 µg/m³ PM_{10}

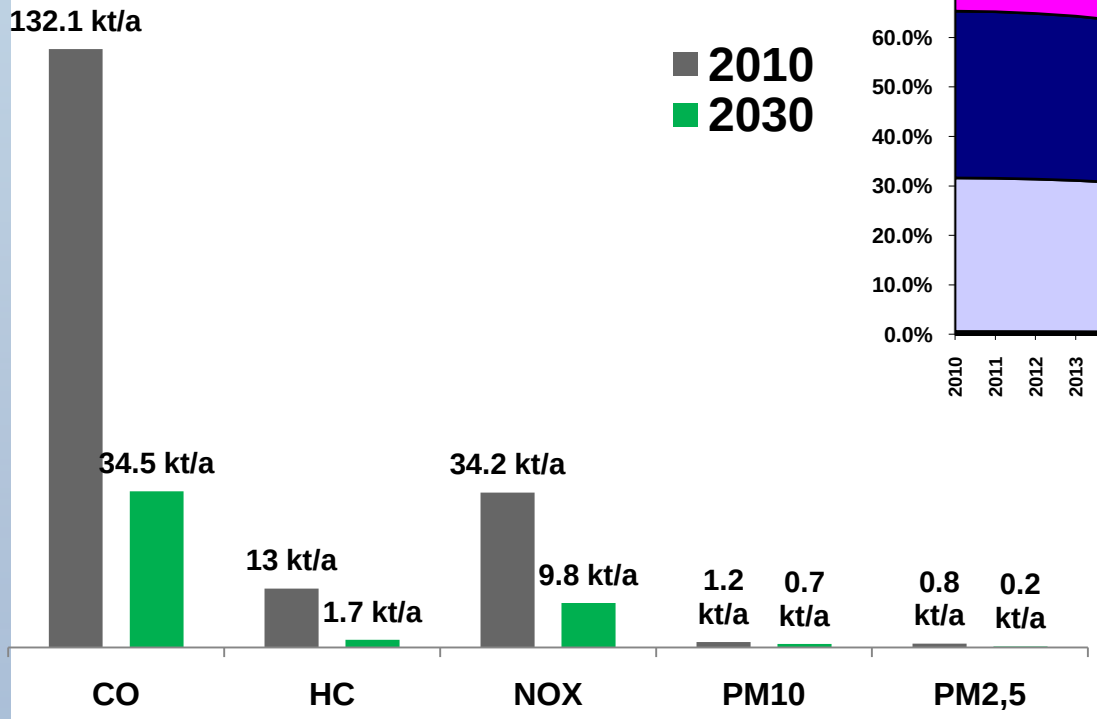
Conclusions

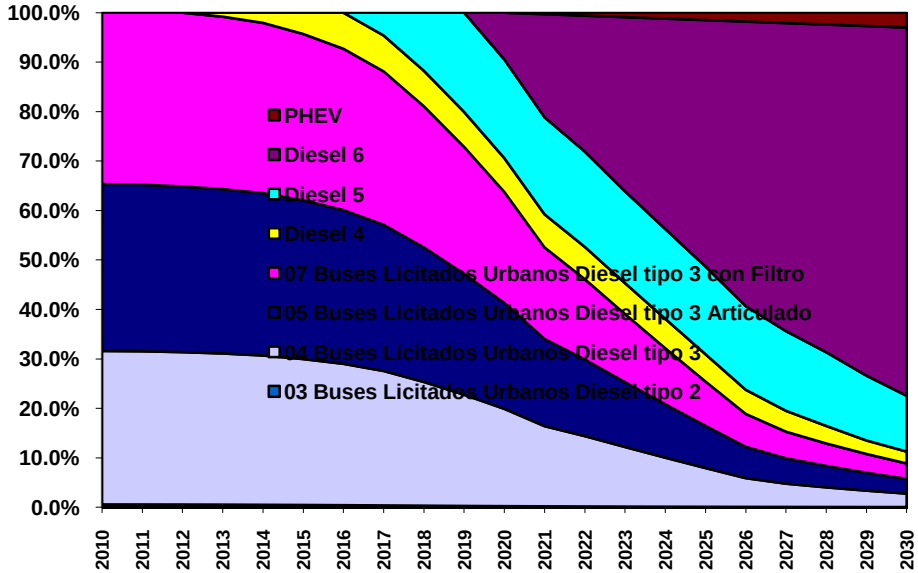
- Complex link between emissions, air quality and health impact is fairly understood - **at risk are not only human beings but also plants, building/cultural heritages**
- Development of emission inventories is a very demanding challenge in terms of input data - **could be demonstrated with traffic emissions**
- Separate air quality platforms can be linked - **basic prerequisite for the definition of indicators**
- Clear relationships exist between PM_{10} and the appearance of environment-related diseases - **risks levels for PM_{10} did not exist**

…many questions are still not finally answered…

Scenarios – First Results

Air Quality & Health





Traffic Scenario BAU

Thank you for your attention

….but also for the very fruitful cooperation and discussions…..

Source: Mickey Ashmore