

# **One of the main FAIRMODE activities: Source apportionment methods for the AAQD**

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TAIEX EPPA Online Regional Workshop on Ambient Air Quality Directive, October 2020

# FAIRMODE: <https://fairmode.jrc.ec.europa.eu/>

**FAIRMODE**  
Forum for air quality modelling in Europe

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**07/2020** Check-out the [MQG guidance \(V3.1\) on Model quality objectives and benchmarking](#)

30/09 - 02/10/2020  
The "FAIRMODE TECHNICAL MEETINGS" will be organized via videoconferenc

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Activities

- QA/QC Protocol for assessment (CT2)
- Src. apportionment (CT1)**
- Microscale modelling (CT4)
- Low-cost sensors (CT6)
- Best practices for AQ management (CT5)
- Emissions (CT7)
- Robustness of AQ projections (CT9)
- Personal indicators (CT3)
- Exposure & exceedance indicators (CT8)

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A - Benchmarking Tool

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## Source apportionment to support air quality management practices

*A fitness-for-purpose guide (V 3.1)*

Thunis, P., Clappier, A., Pirovano, G.

With contributions of: Pisoni, E., Guerreiro, C., Monteiro, A., Dupont, H., Riffaut, V., Waersted, E., Hellebust, S., Stocker, J., Gilardoni, S., Eriksson, A., Angyal, A., Bonafe, G., Montanari, F., Matejovica, J., Bartzis, J.

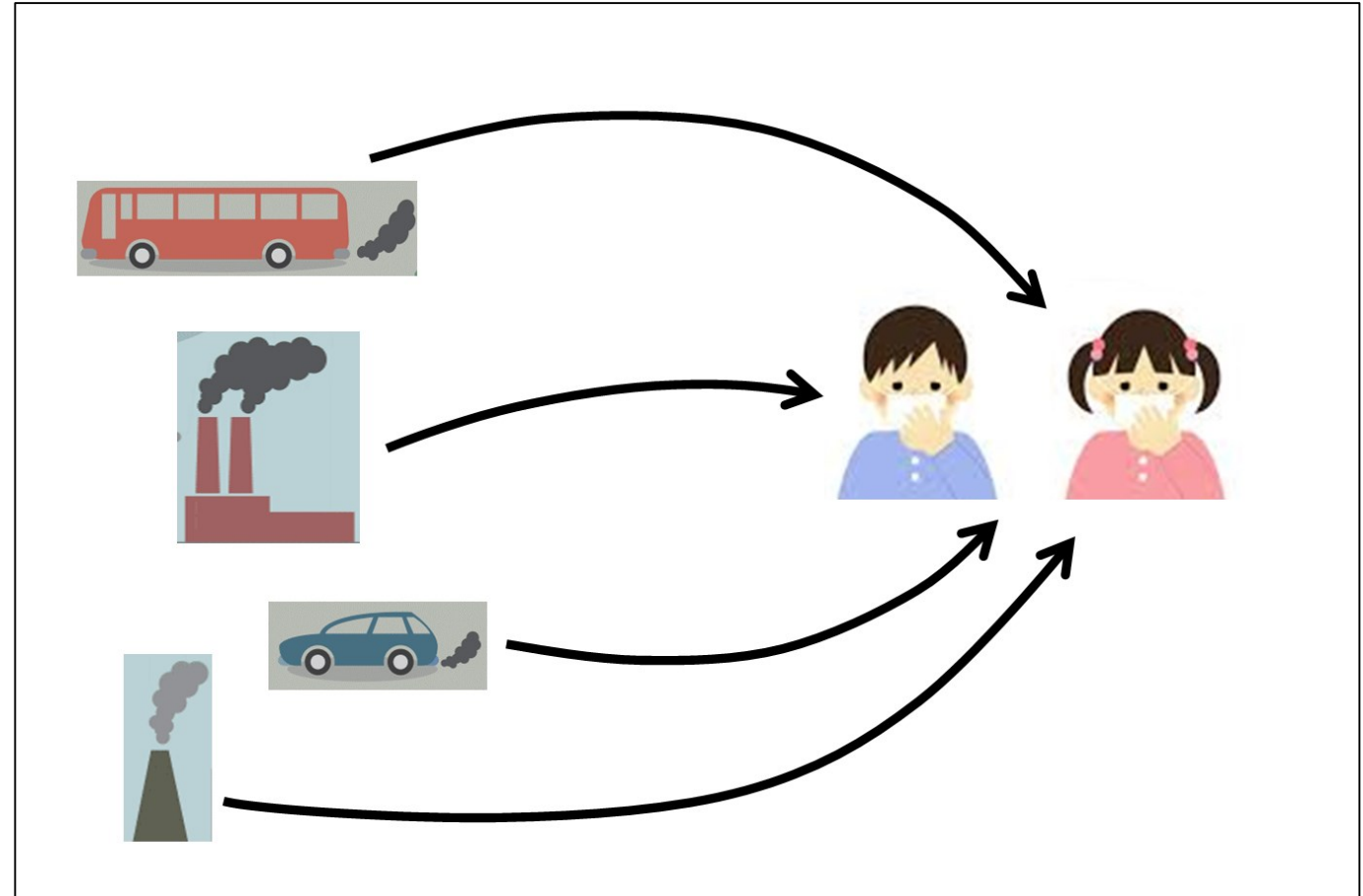
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EUR 30263 EN

# What is Source Apportionment?

Source apportionment is a technique used to **relate emissions from various pollution sources to air pollution concentrations** at a given location and for a given time period.

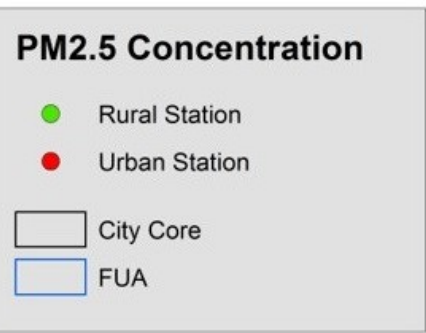
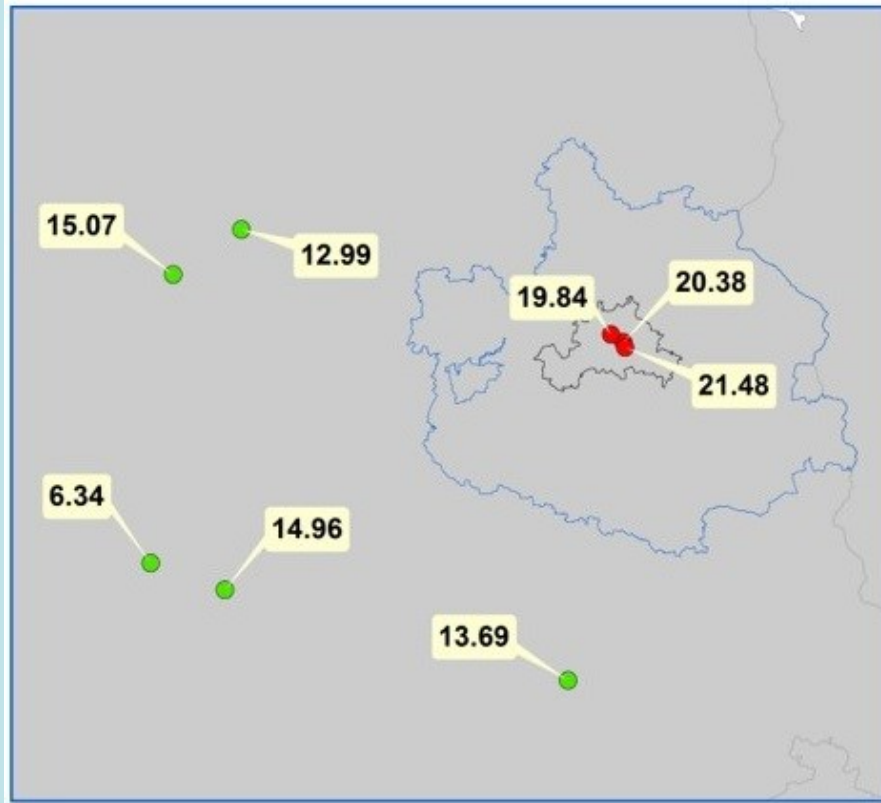


# Increment:

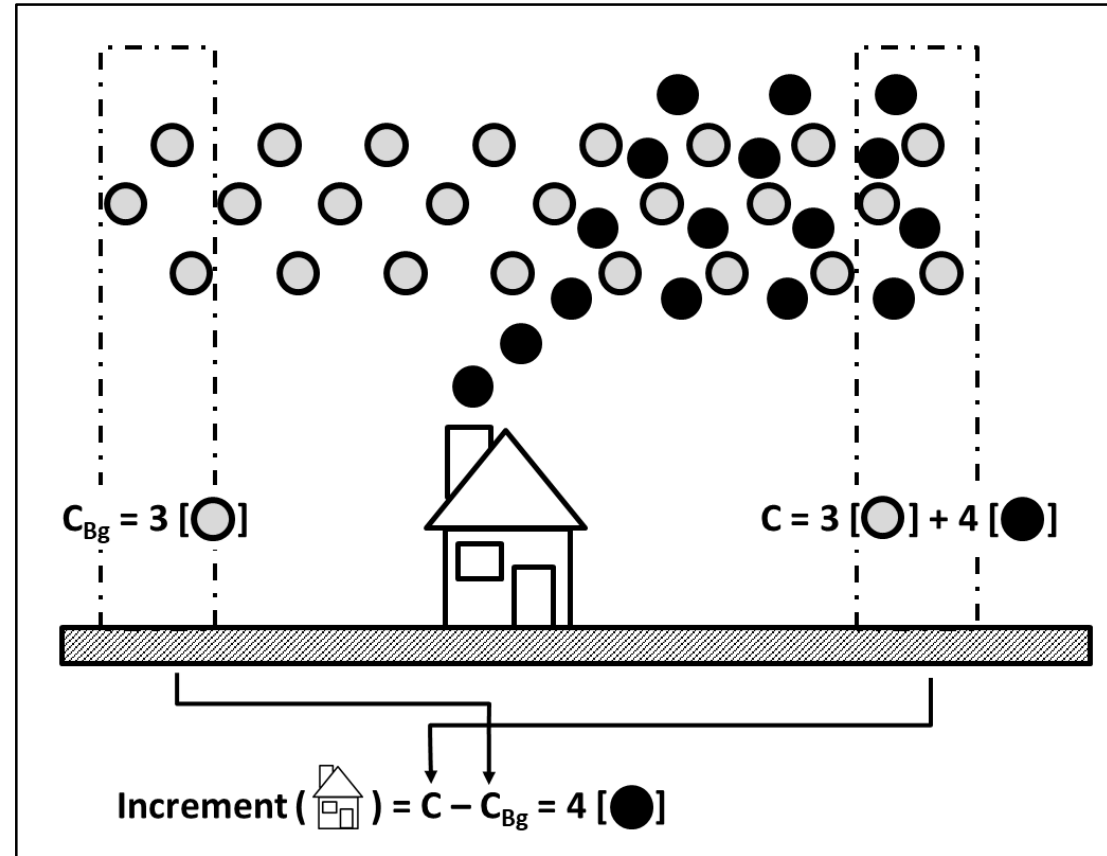
computing differences between several observation sites



## Example: PARIS



● and ○ = PPM

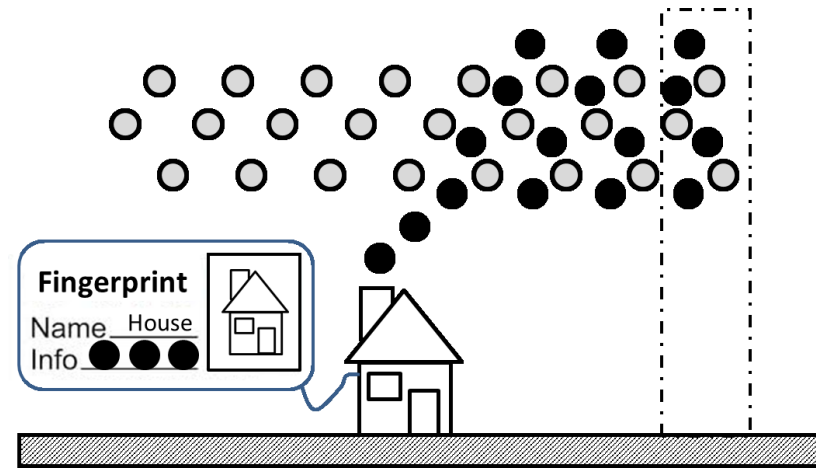
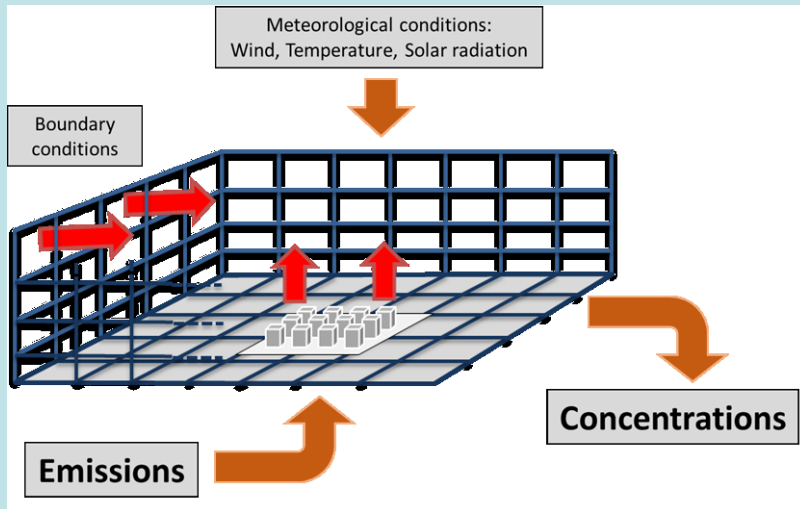


# Receptor and Tagging Contributions: tracing pollutant mass

## Observations

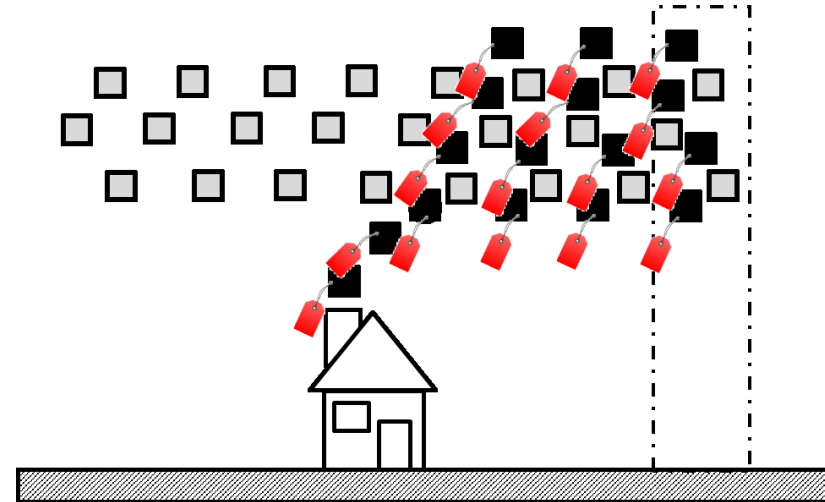


## Models



● and ○ = PPM

Contribution (🏠) = 4 [●]

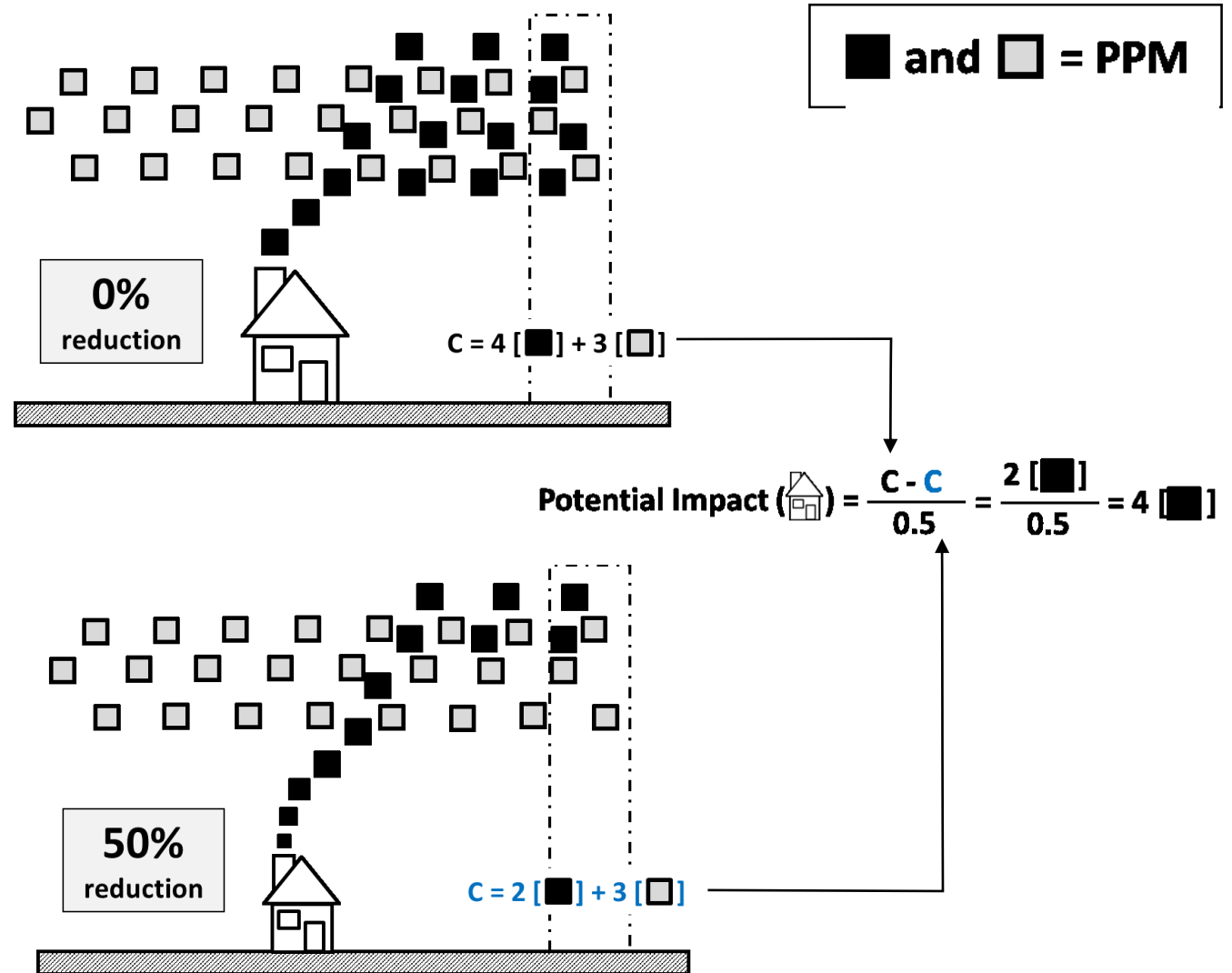
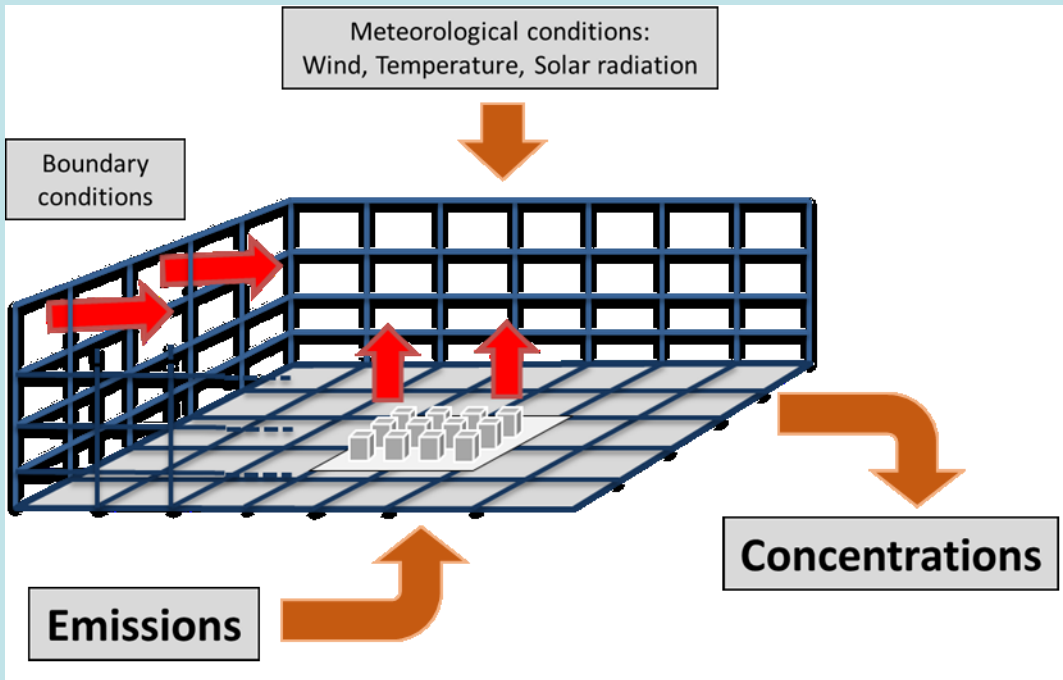


Contribution (🏠) = 4 [■]

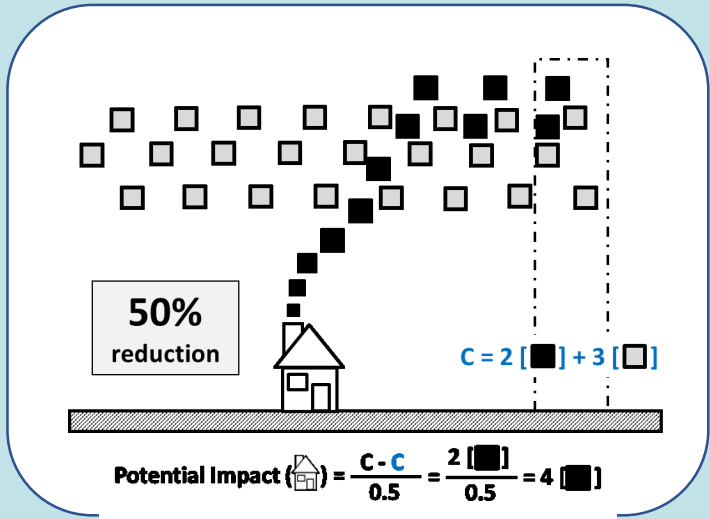
# Potential Impacts:

simulating the effects of reduction scenarios

## Air Quality Model

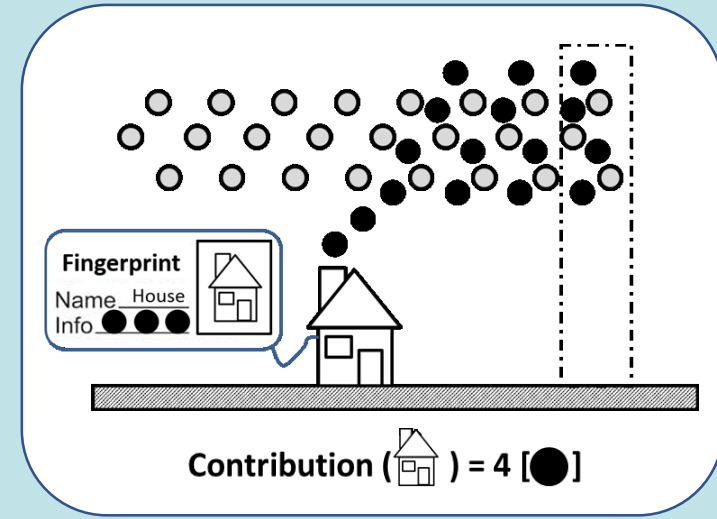


# In "basic" situations all methods give the same results BUT...

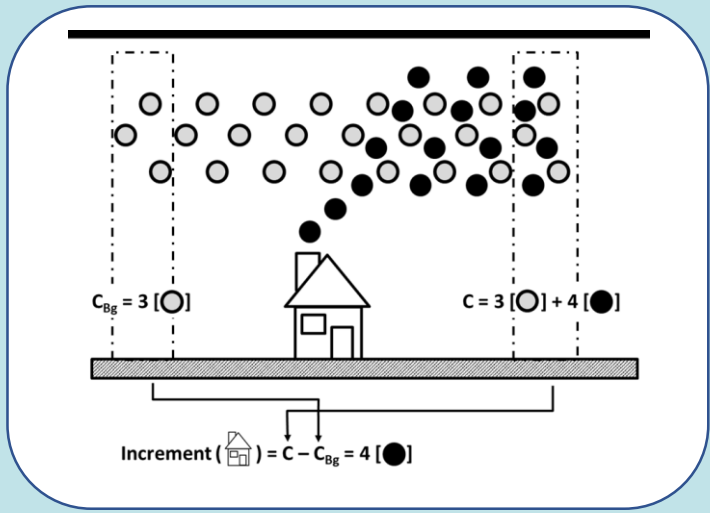


## Potential Impacts

GAINS  
EMEP (CAMS)  
SHERPA  
CAMx

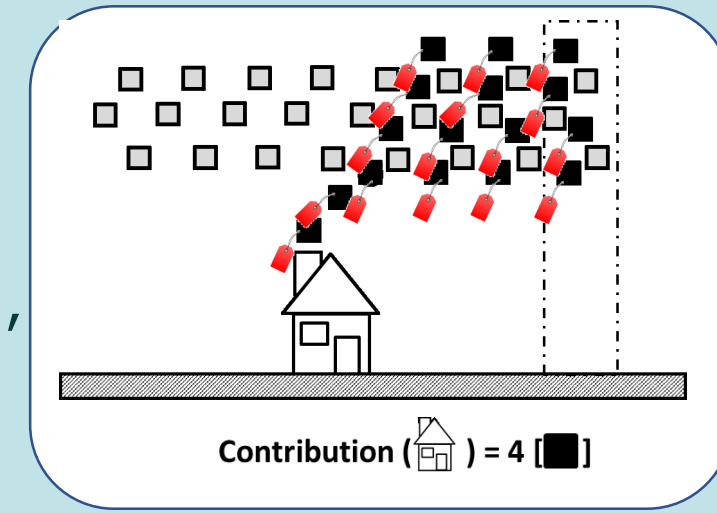


## Receptor contributions



## Increments

Local AQP  
(Berlin, Stockholm,  
Sofia...)



## Tagging contributions

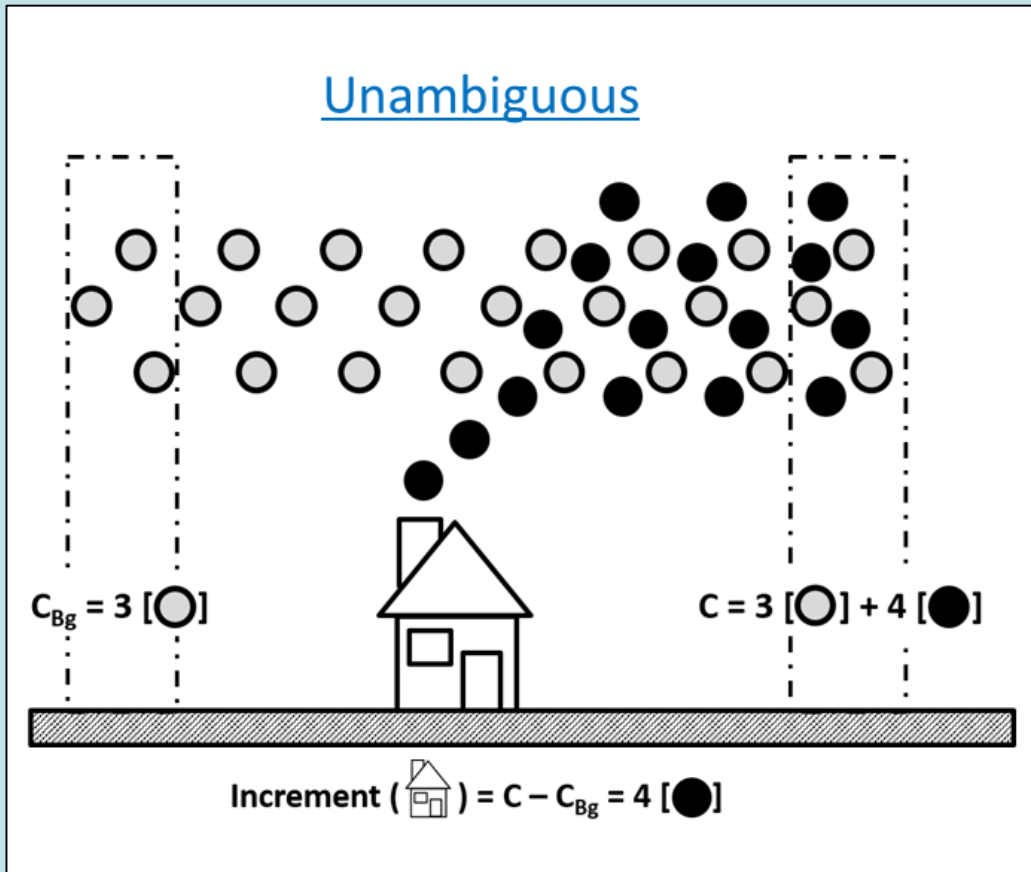
LOTOS (CAMS)  
LOTOS (TOPAS)  
CAMx  
CMAQ

# Why Incremental Components are Impossible to Interpret?

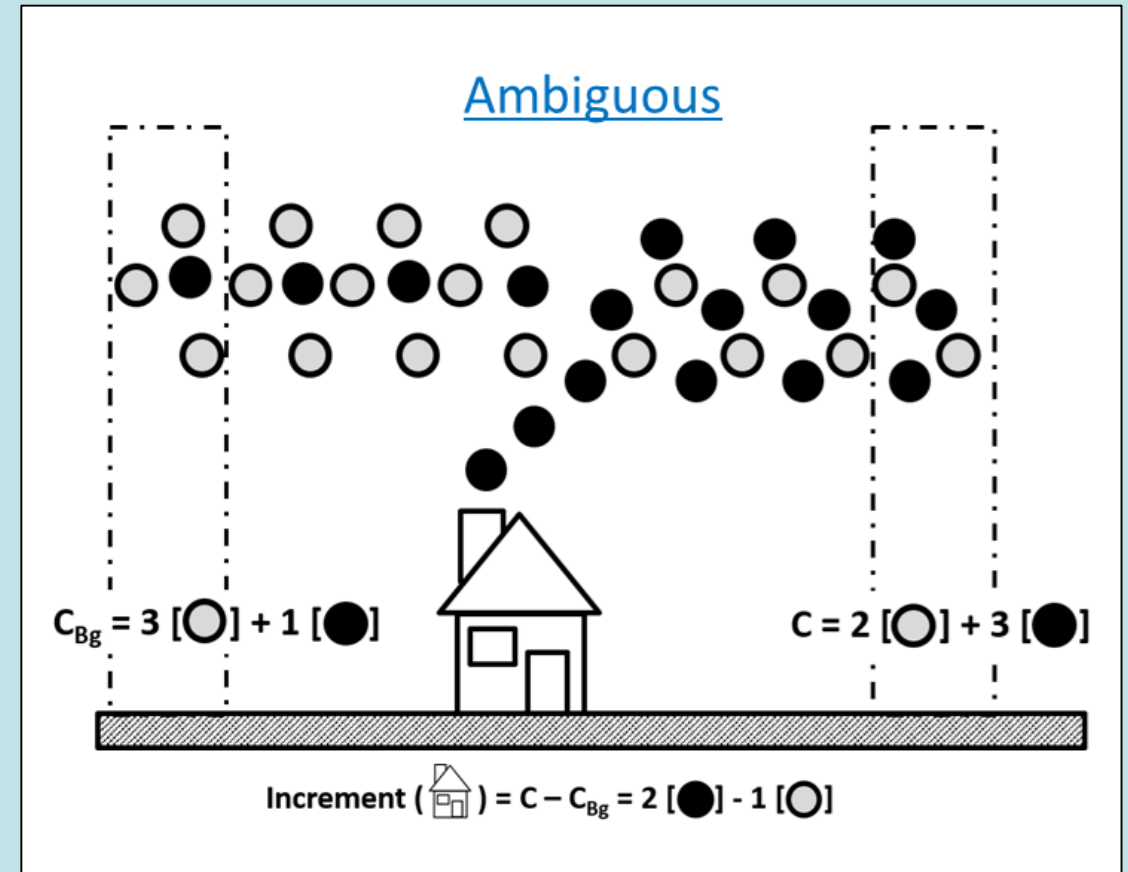
Components computed with the increment method are always ambiguous.

● and ○ = PPM

Unambiguous



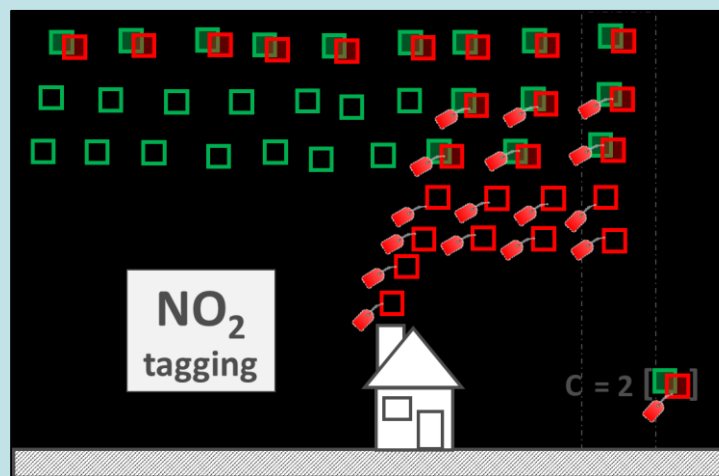
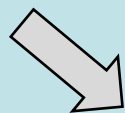
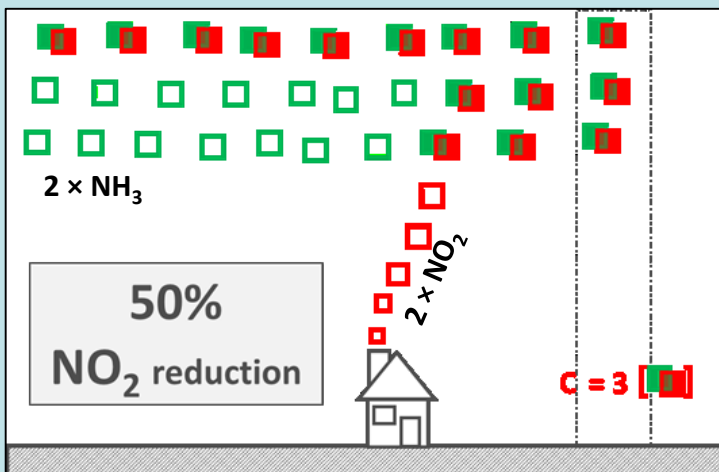
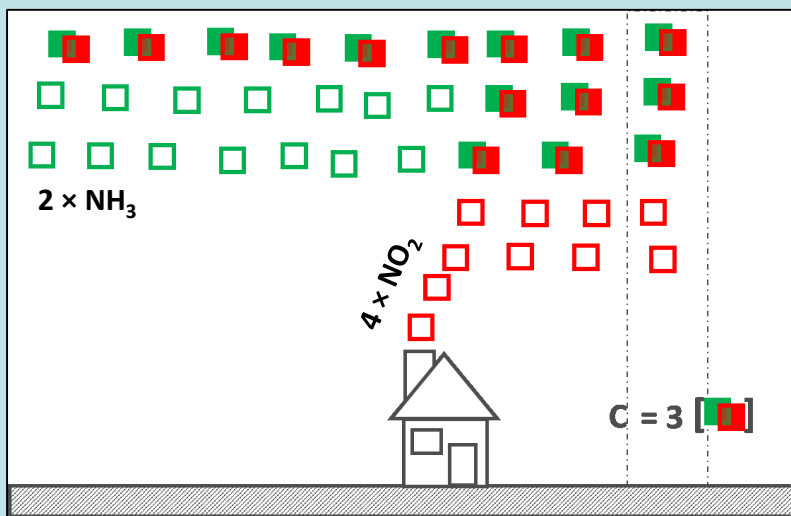
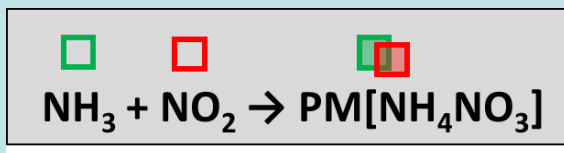
Ambiguous





# What are the Effects of Nonlinearity?

1. Tagging contributions and Potential Impacts give different results:

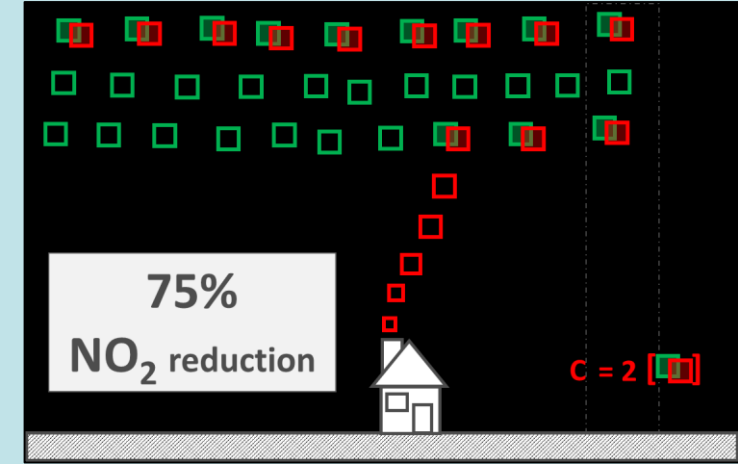
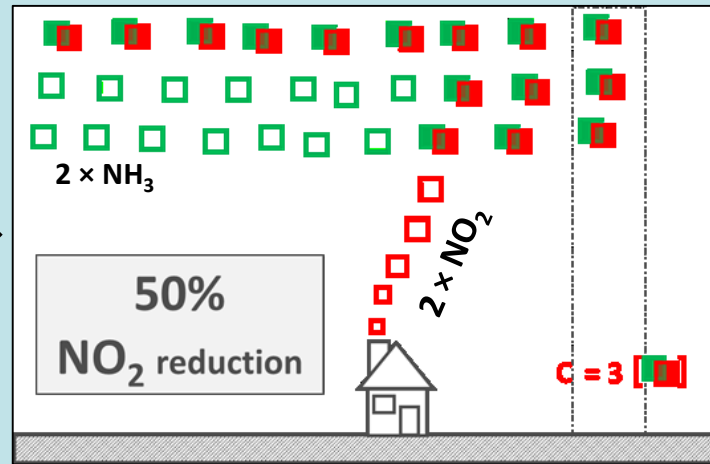
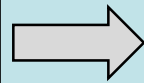
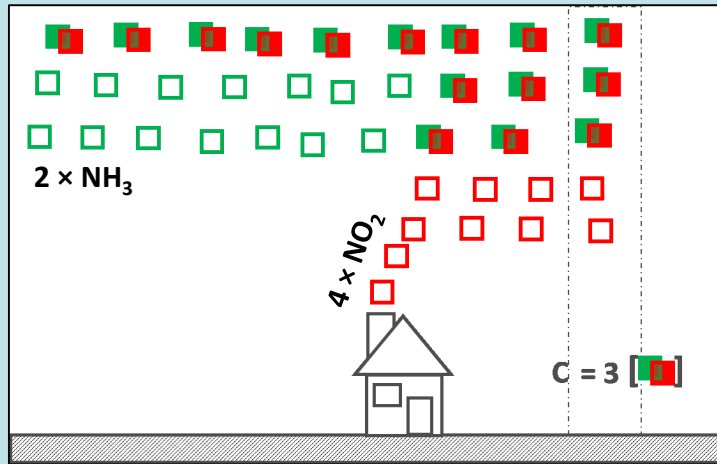
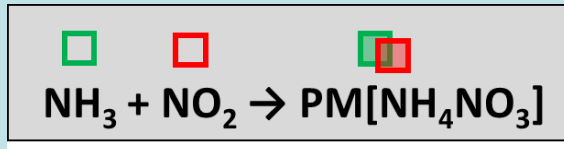


$$\text{Potential impact (NO}_2\text{)} = \frac{C - C}{0.5} = \frac{0 [\text{PM}]}{0.5} = 0 [\text{PM}]$$

$$\text{Contribution (NO}_2\text{)} = 2 [\text{PM}]$$

# What are the Effects of Nonlinearity?

2. Potential Impacts are changing with the percentage of emission reduction:



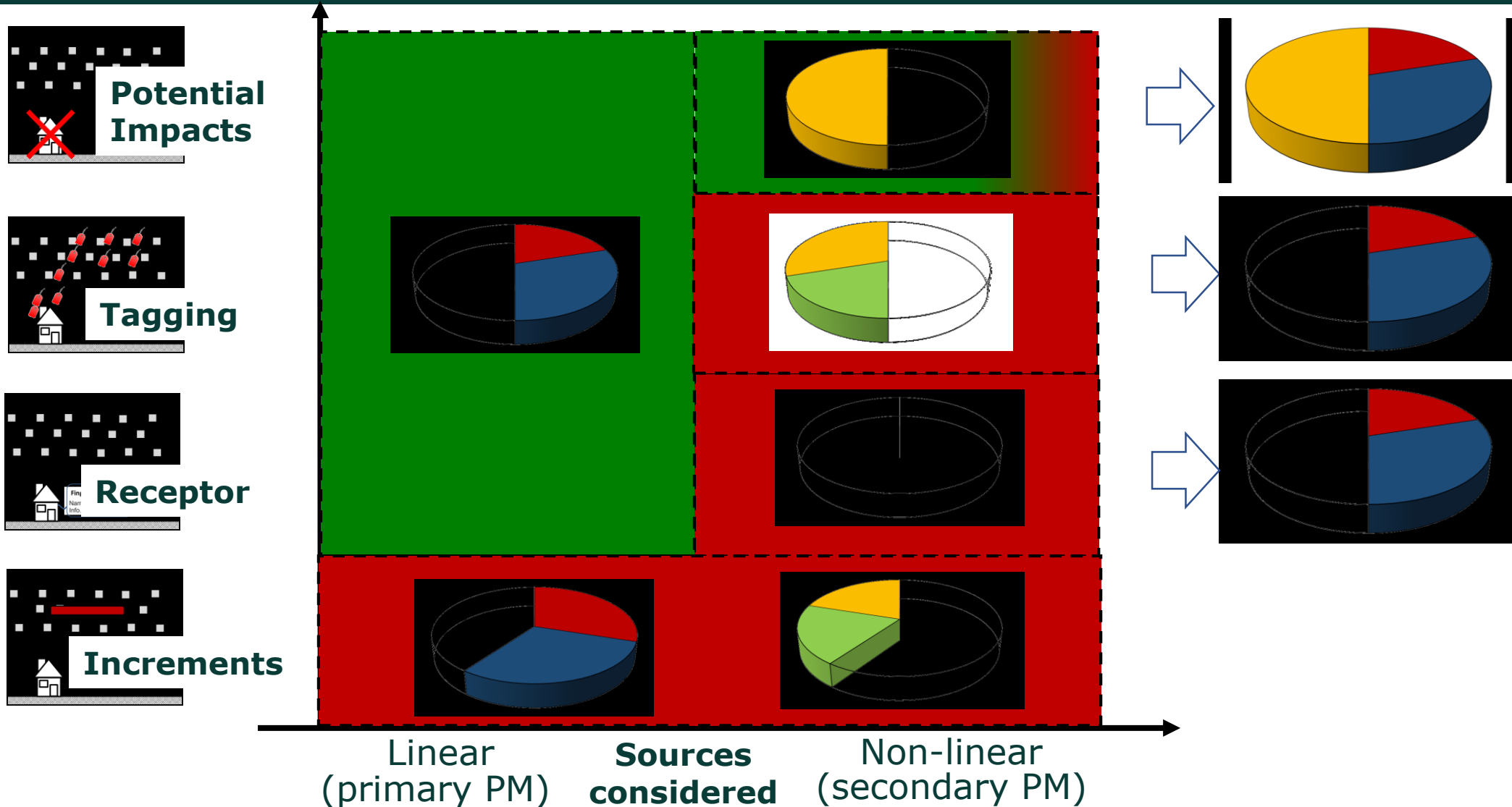
$$\text{Potential impact (NO}_2) = \frac{C - C}{0.5} = \frac{0 [\text{red}]}{0.5} = 0 [\text{red}]$$

$$\text{Potential impact (NO}_2) = \frac{C - C}{0.5} = \frac{1 [\text{red}]}{0.5} = 2 [\text{red}]$$

Experience shows that the Potential Impacts remain constant over a limited range of emission reduction (until 50%)

# FAIRMODE Recommendations (2019)

*What is the concentration change expected from a given emission change ?*



**Thank-you**