

THE ROLE OF TIME SCALE IN ASSESSING EXTERNAL COSTS OF METAL EMISSIONS

MASSIMO PIZZOL PhD
DEPARTMENT OF ENVIRONMENTAL SCIENCE



EXTERNALITIES

› Uncompensated environmental costs



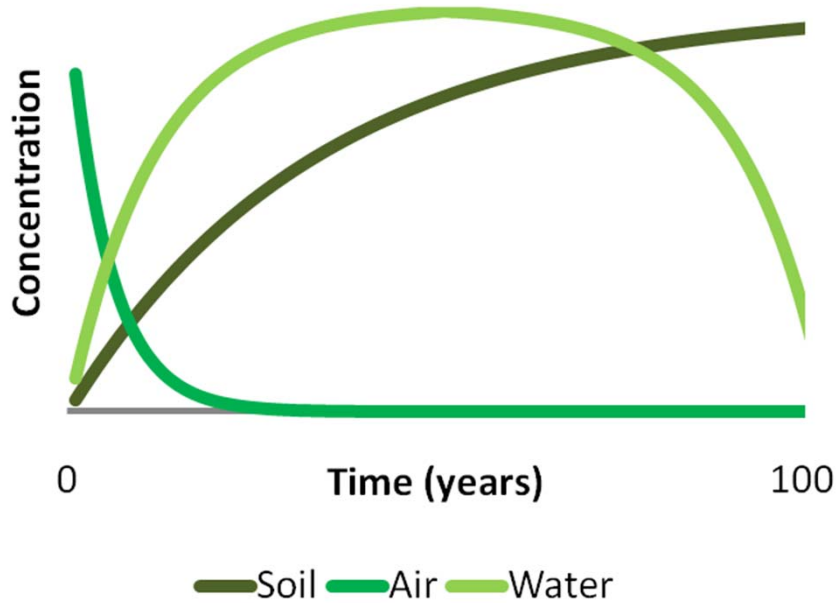
→ $F(x)$ →



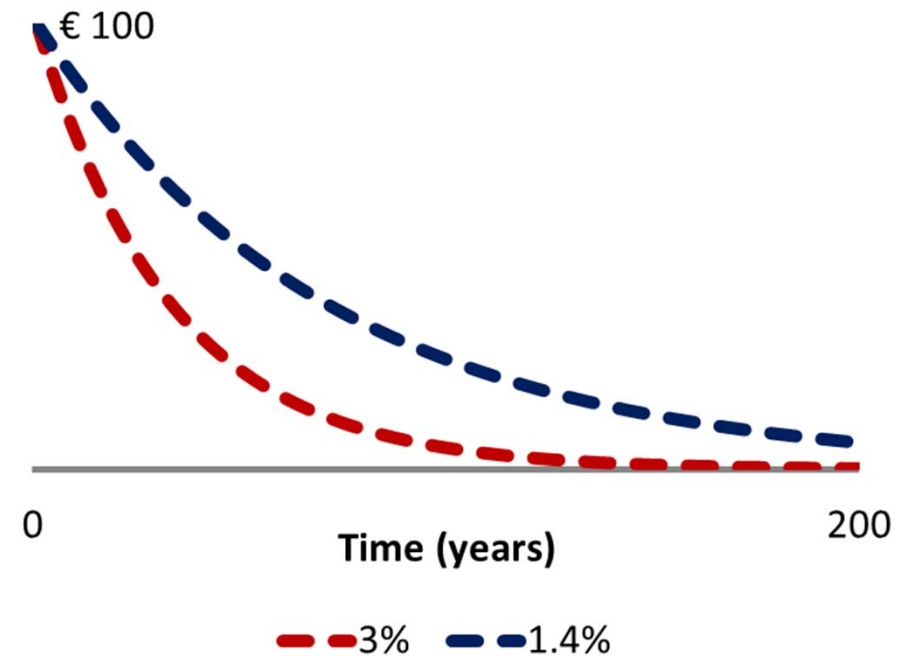
› Impact Pathway Approach (IPA)
› Emission - Dispersion - Impact - Cost [€/kg]

TIME ASPECTS

ENVIRONMENTAL (accumulation)

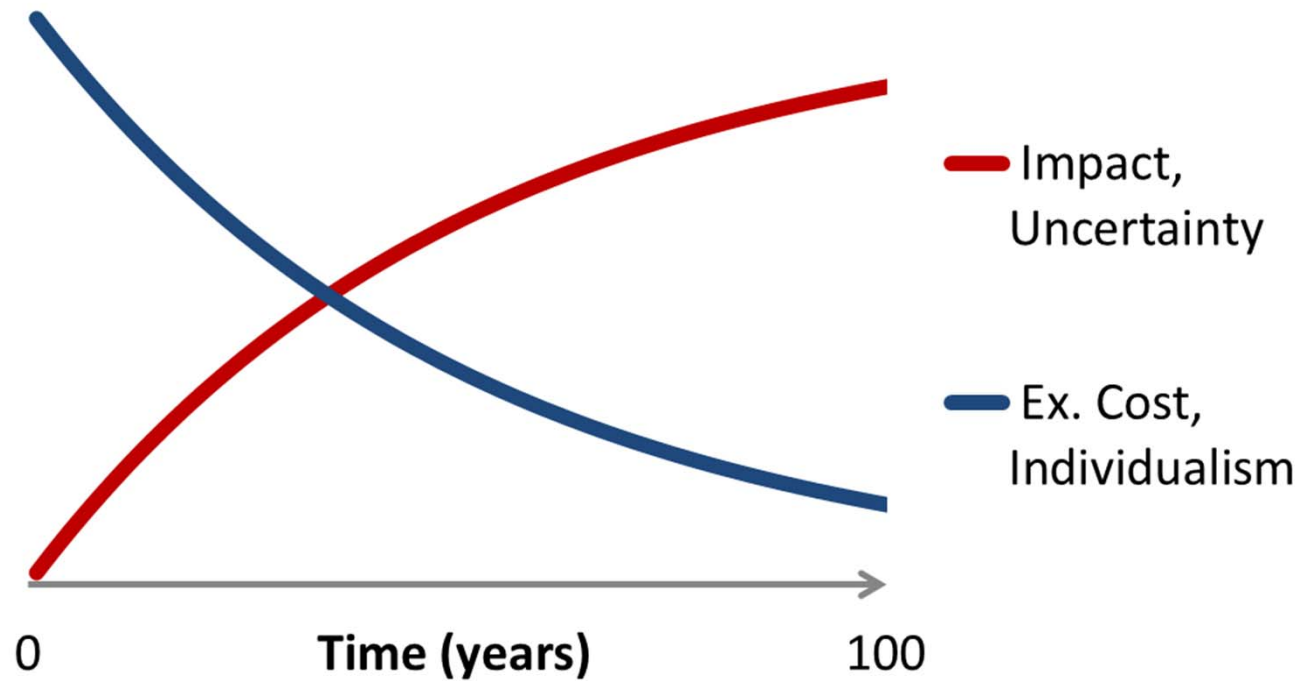


ECONOMIC (discounting)



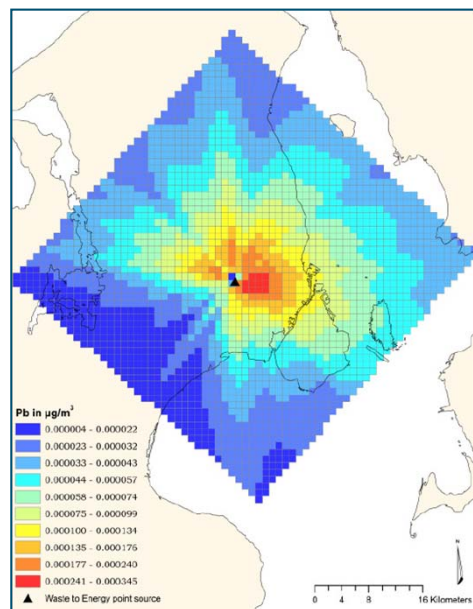
TRADE OFFS

- > CHOICE OF TIME SCALE
- > IN THE ANALYSIS / DECISION MAKING



LEAD (Pb) IMPACT PATHWAY (1)

DISPERSION (Δ -Pb)



(Olesen et al., 2007)

MULTIPATHWAY EXPOSURE (Δ -Inhalation, Δ -ingestion)

$\rightarrow F(x) \rightarrow$



(Pizzol et al., 2010)

LEAD (Pb) IMPACT PATHWAY (2)

$IQ_{\text{loss}} / Pb_{\text{blood}}$
(Schwartz et al., 1994)

$€ / IQ_{\text{loss}}$
(Pizzol et al., 2010)



LIFETIME EARNINGS REDUCED BY
IMPAIRED NEURODEVELOPMENT

Pb EXTERNALITIES (inhalation)

> RESULTS AND UNCERTAINTY

| Euro Loss / Pb kg emitted (Ref. year 2000) | Discount rate | € /kg | | |
|---|---------------|-------|------|-------|
| | | lower | base | upper |
| 0 < pop < 2 years | 3% | 36 | 50 | 63 |
| 0 < pop < 3 years | | 59 | 83 | 98 |
| 0 < pop < 2 years | 1,4% | 71 | 98 | 124 |
| 0 < pop < 3 years | | 117 | 162 | 203 |

(Pizzol et al., Environmental Health, 2010)

Pb EXTERNALITIES AND TIME SCALE

FUTURE EMISSION SCENARIO:

- > ACCUMULATION OF Pb IN MEDIA (e.g. SOIL)
- > VALUES TO BE DISCOUNTED

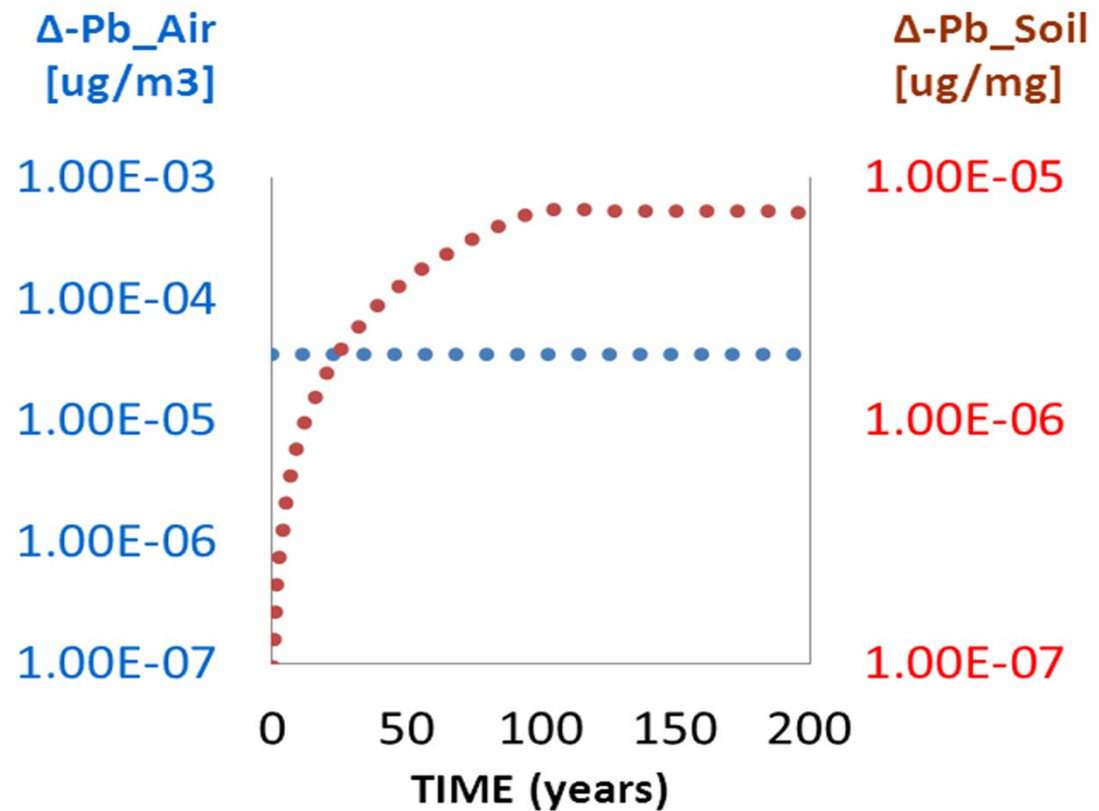


TRENDS IN MEDIA Pb CONC.

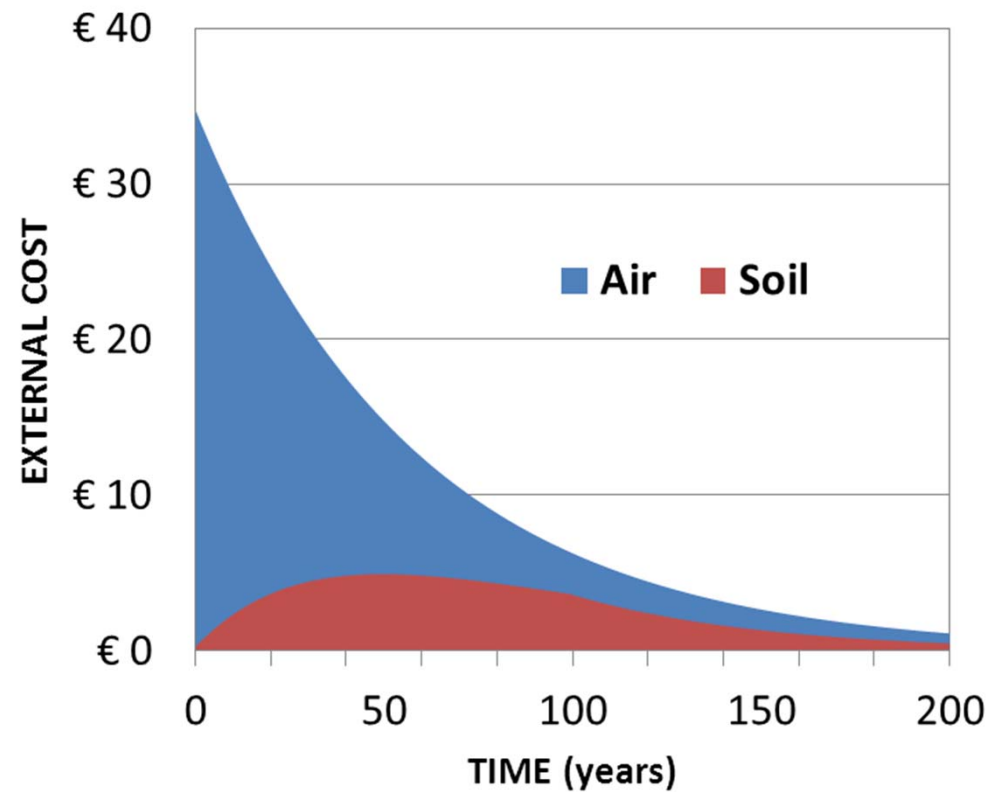
ACTUAL
EMISSION RATE
200y FUTURE
SCENARIO

> CONSTANT
Pb_Air

> INCREASING
Pb_Soil



TOTAL Pb EXTERNALITIES



> ACCUMULATION vs.
DISCOUNTING

> € INHALATION > €
INGESTION

REDUCING Pb EXPOSURE (1)

AIR POLLUTION
CONTROL DEVICES
(APCD)



ACTUAL SOURCES

REPLACEMENT OF
CONTAMINATED SOIL
e.g. kindergardens
(DEPA, 2003, 2008)



HISTORICAL
CONTAMINATION

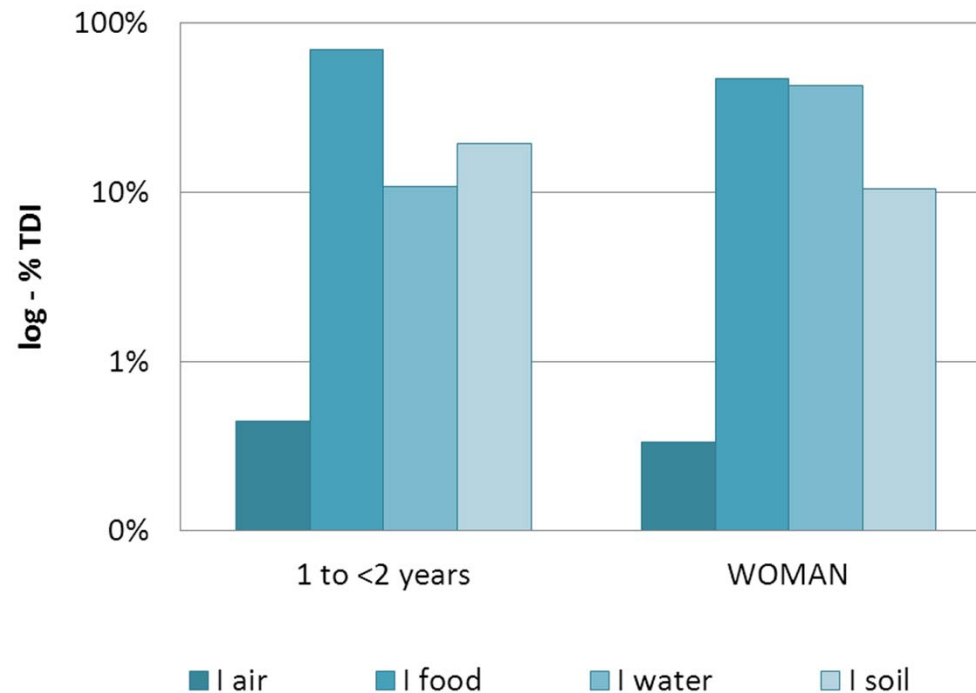


REDUCING Pb EXPOSURE (2)

APCD vs. SOIL REMEDIATION - DIFFERENCES

> No. CHILDREN UNDER EXPOSURE

> MAIN EXPOSURE PATHWAY



REDUCING Pb EXPOSURE

(3)

> AVOIDED EXTERNAL COSTS

| Pb External Cost | APCD | Soil Remediation |
|------------------|----------|------------------|
| € / kg | € 35 | € 4,434 |
| € / kg / child | € 0.0006 | € 185 |
| € | € 33,971 | € 44,337 |
| € / child | € 0.58 | € 1,847 |

> TOTAL COST HAVE SAME MAGNITUDE

> DIFFERENCES IN COST per/kg

WRAP UP

- › EMISSION – IMPACT- COST
- › TIME ASPECTS AND TRADE OFFS
- › MEDIA ACCUMULATION vs. VALUE DISCOUNTING
- › ACTUAL vs. HISTORICAL SOURCES

› CHOICE OF TIME SCALE → EX. COST → DECISION MAKING

THANK YOU

