

23.ETH-NPC – Zürich June 2019
Focus Event

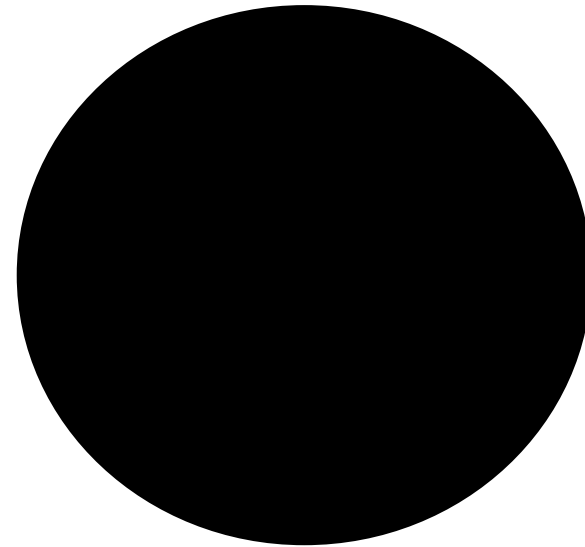
Holistic Approach *to characterize and eliminate toxic substances emitted by combustion engines a challenge across disciplines*

A.Mayer / VERT
«holistic» from «ὅλος» not from «hollín»



far too complex

far too complex
Can't we replace it by
one black spot of equal
amount of ink



**“ .. esto importa poco a nuestro
cuento; basta que no se salga
un punto de la verdad ”**

Miguel de Cervantes
El ingenioso hidalgo

**No, we can not -
but in emission policy we are replacing**

1000 different hydrocarbons of toxicity ranging 1:10'000
from ethanol to benz(a)pyren
by their total mass THC g/kWh

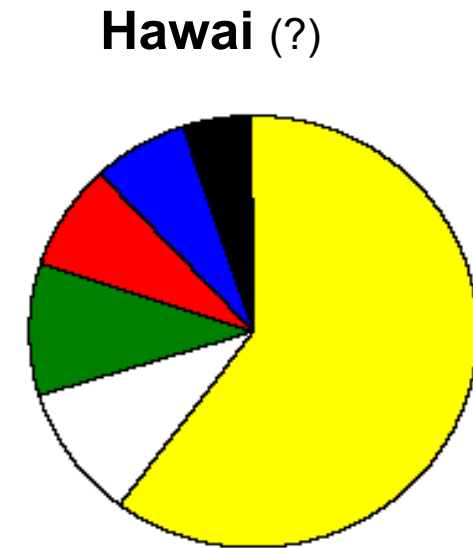
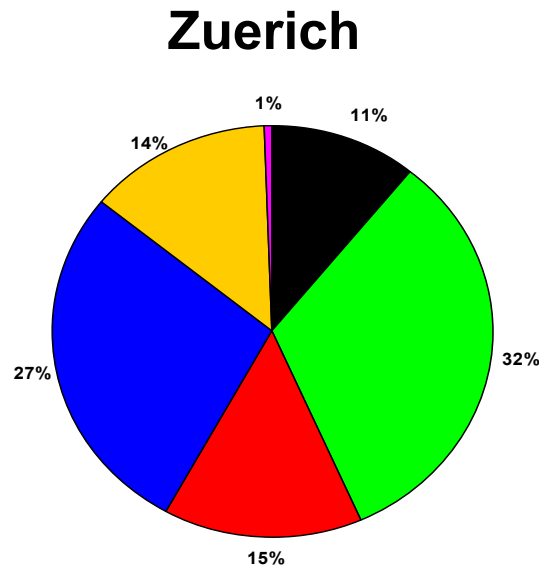
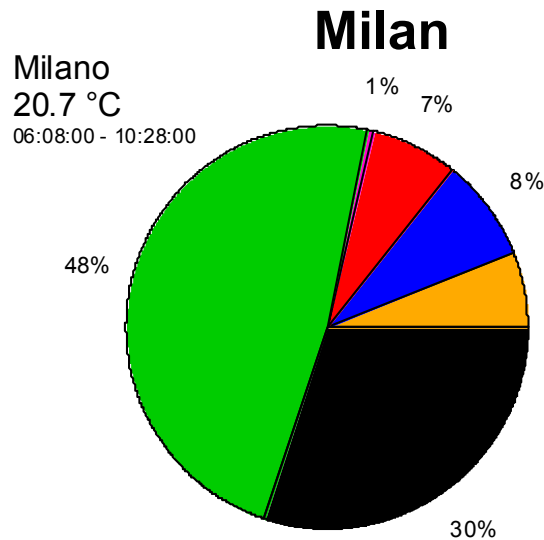
100 different particulate substances of different grain or
droplet size from water to carcinogenic soot
by their total mass PM10

2 different Nitrogen oxides, NO and No2 toxicity 1:10
by one fictive substance NOx

and base our regulation on that!

What is PM - Mass [mg/m³] of what ?

mix of unspecified substances – which is the toxic one ?



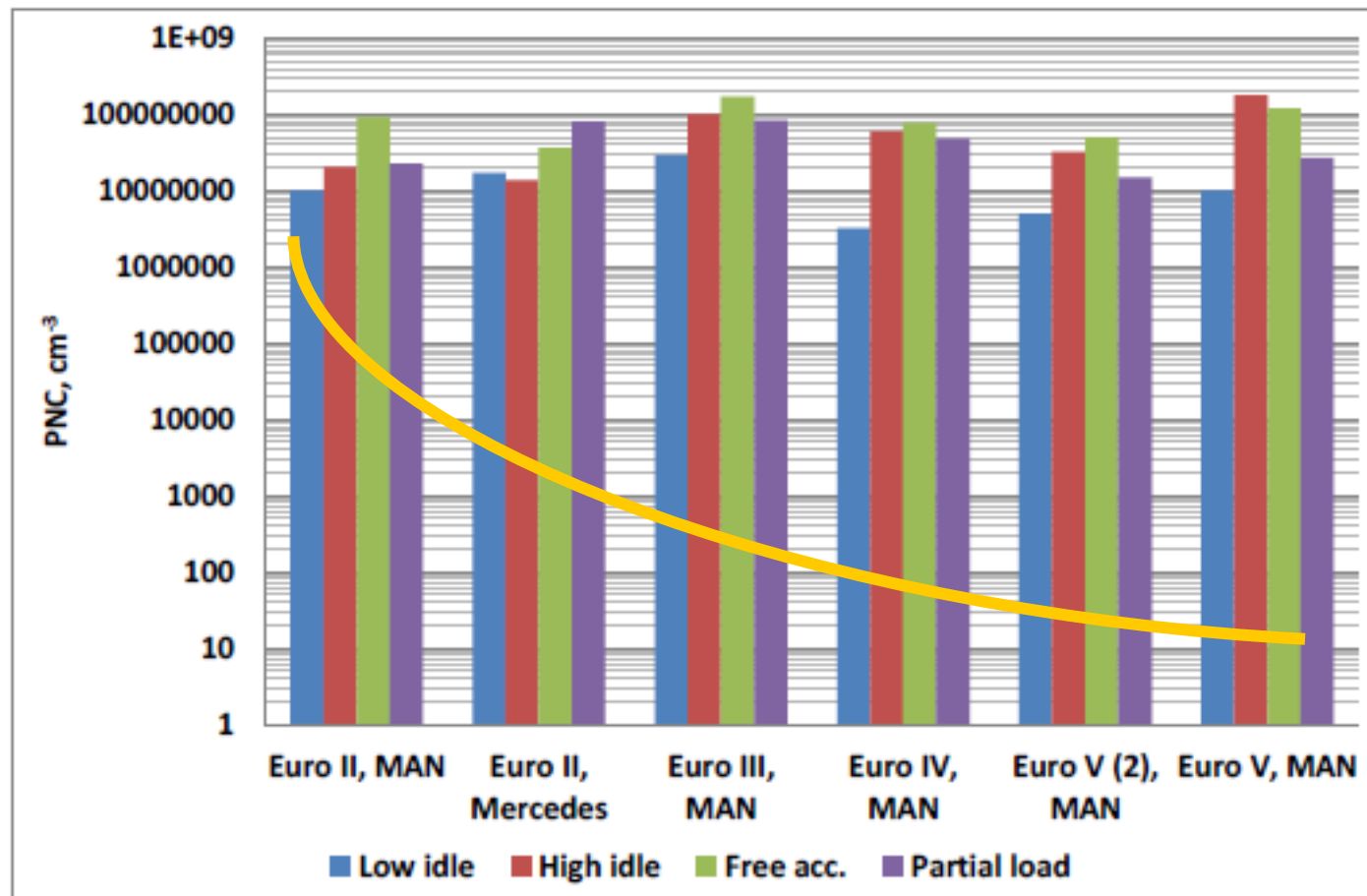
Public Health Science 1993 – 2018 ...
«Total mass of airborne particulate matter
is the correct parameter for health impact»

Black Carbon
Organic mass
Nitrate
Sulfate
Ammonium
Chloride

Is this true? -- dubito ergo sum

What happened in Europe and in the USA?

→ PM reduction – PN stagnation



PM

Guided by Occupational Health

starting aerosol science in
mines had defined Particles
Sizes deposited in Lung
Compartments in 1959

VERT:

SUVA, AUVA, TBG

required elimination of **solid
insoluble particles**

< 500 nm

and to limit each substance
individually

PROCEEDINGS OF THE Pneumoconiosis Conference

*held at the
University of Witwatersrand, Johannesburg
9th – 24th February, 1959*

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Bibliothek
Allg. Univers.- u. s.
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LONDON

J. & A. Churchill Ltd.
104 GLOUCESTER PLACE, W.1.

1960

2. 11. 1969

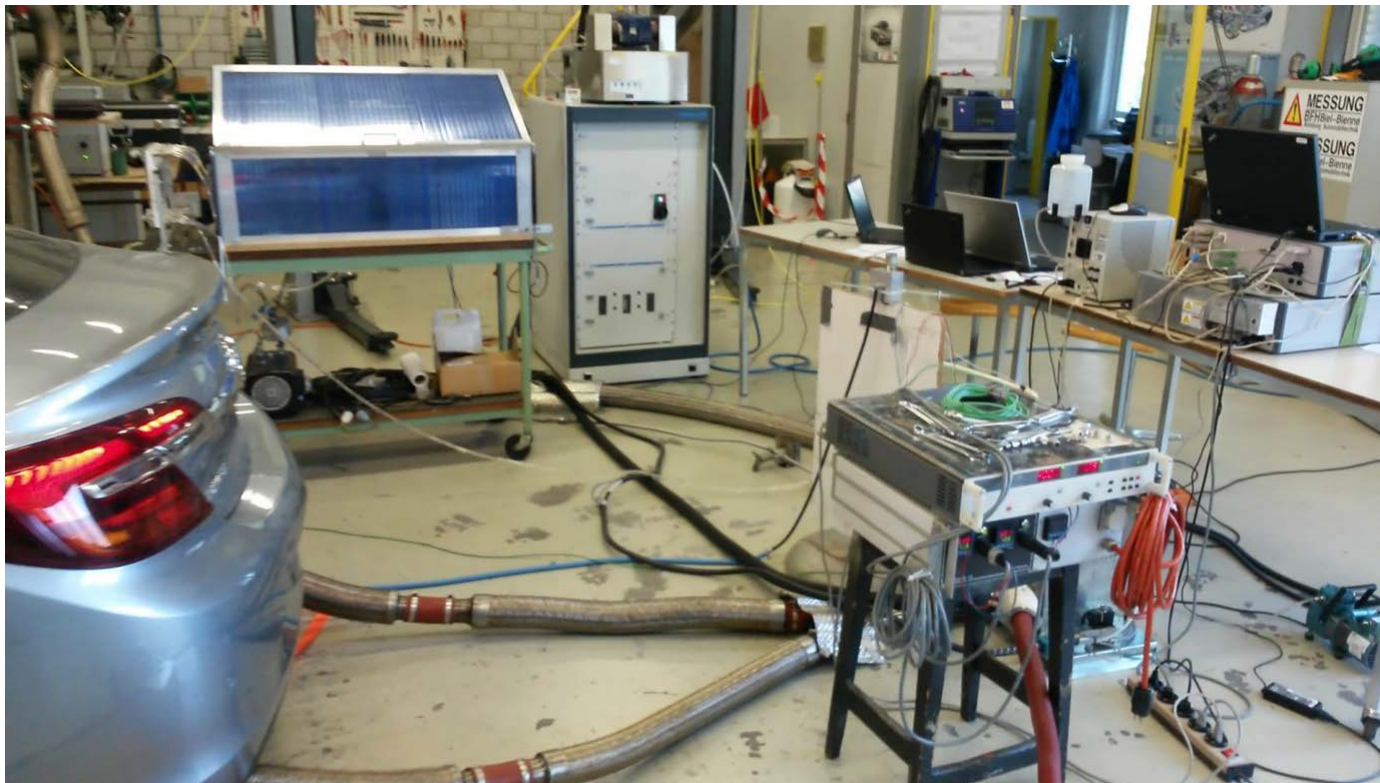
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Starting Biologic Research

aerosol exposure from different technology
to human lung cells

the closest one can be to reality

→ Metals → NO₂ → SOA → Fuels → Lubes → Catalysts



Test vehicle

Exhaust sampling

Table 1 Air pollution cost factors in EUR/ton of pollutant (€₂₀₀₈ values)

Pollutant	PM _{2.5} (exhaust)			PM ₁₀ (non-exhaust)			NO _x	NMVOC	SO ₂
Region type	Metropolitan	Urban	Non-urban	Metropolitan	Urban	Non-urban			
Source	HEATCO	*UBA/ HEATCO	HEATCO	*UBA/ HEATCO	*UBA/ HEATCO	*UBA/ HEATCO	NEEDS	NEEDS	NEEDS
Country									
Austria	482,200	155,900	80,700				10'000	1'600	10'000
Belgium	483,400	156,000	104,400				10'000	2'600	10'900
Bulgaria	70,500	22,700					10'000	400	6'200
Czech Republic	355,400	114,500					10'600	1'100	9'500
Denmark	436,400					20,500	5'300	1'200	5'700
Estonia	266,300				34,000	17,700	2'800	600	4'500
Finland	432,000				55,800	14,400	2'600	600	3'500
France	438,600			175,500	56,500	35,100	10'500	1'400	9'900
Germany	430,300			172,100	55,500	33,600	12'700	1'400	10'900
Greece	338,600		77,700	135,400	43,600	19,100	2'700	600	5'800
Hungary	288,900		74,100	115,600	37,200	29,600	12'400	1'000	9'100
Ireland	537,200	173,400	56,200	214,900	69,300	22,500	4'400	1'100	5'400
Italy									
Latvia									
Lithuania	266,300	86,500	53,300	106,500	34,600	21,300	5'600	800	5'700
Luxembourg	877,100	282,400	125,000	350,800	112,900	50,000	12'700	2'400	10'300
Switzerland			498,700		160,500	82,400			

Switzerland	498,700	160,500	82,400
Poland	248,900	79,900	74,700

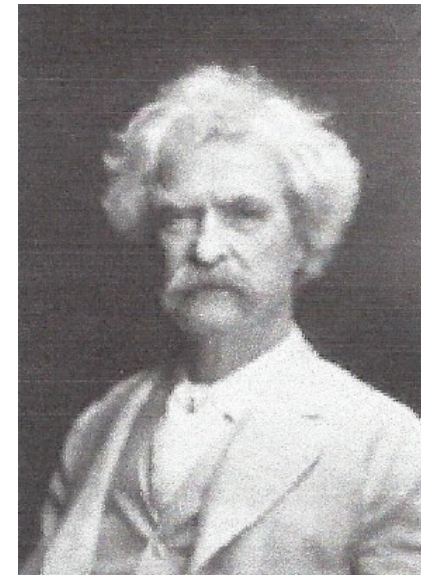
and never forget the money involved
Benefit/Cost > 10

Value chosen: 460 CHF/kg PM₁₀

We conclude that we
should exploit our knowledge
and use our expertise and toolbox
in order to apply Best Available Technology
to detoxify engine exhaust gases for public health

and we believe that post-Euro6 is a wonderful
opportunity for this
so let's see our suggestions

*«What gets us into trouble is not
what we don't know
It's what we know for sure that
just ain't so»*



FOCUS-Event: Not just Diesel-Soot → Detox all Combustion Engines 13.30 – 16.20

Introduction and Chair: Mayer Andreas

Section I:

13.30 – 14.40

Czerwinski Jan / AFHB, Biel, Switzerland

Physical Properties of Particles are Co-responsible for Toxic Effects

Heeb Norbert / EMPA, Dübendorf, Switzerland

Adsorbate Chemistry of Combustion Generated Nanoparticles from Diesel and Gasoline Engines

Rothen-Rutishauser Barbara / University of Fribourg, Switzerland

Point of View of a Biologist on Combustion Engine Exhaust –

Current Knowledge of Adverse Effects and Underlying Cellular Mechanisms

COFFEE BREAK

14.40 – 15.10

Section II:

15.10 – 16.20

Hüglin Christoph / EMPA Dübendorf, Switzerland

Regulations for Vehicle Emissions and Ambient Air Quality – Is there a Need for Harmonization?

Hensel Volker / VERT, Heidelberg, Germany

Fleet – Upgrade, an Absolute Must to Clean Urban Air

Mayer Andreas / TTM, Niederrohrdorf, Switzerland

Emission Reduction Measures Recommended for „Post Euro 6“

