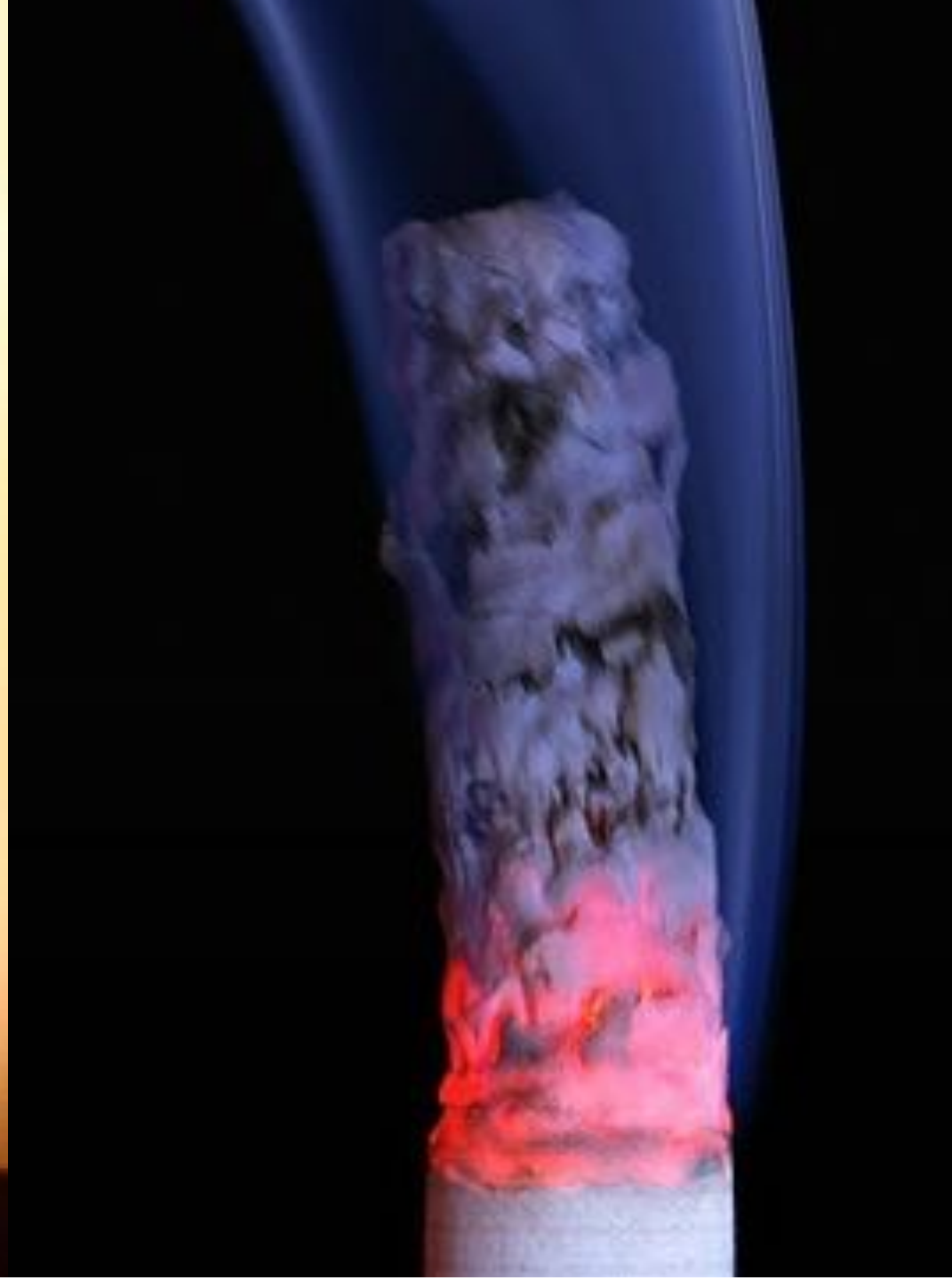


**Aerosols, a tool for assessing
airborne transmissions of hazardous
substances and agents**

Michael Riediker



What are the hazards of aerosols?



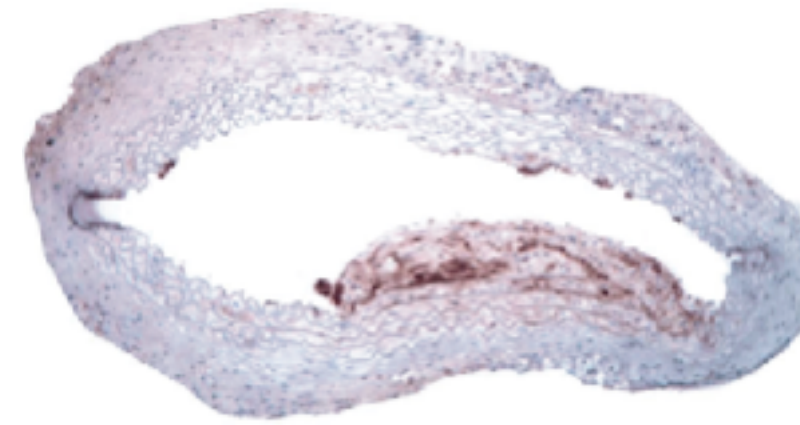
From the lungs to other organs

Lung overload and lung toxic effects

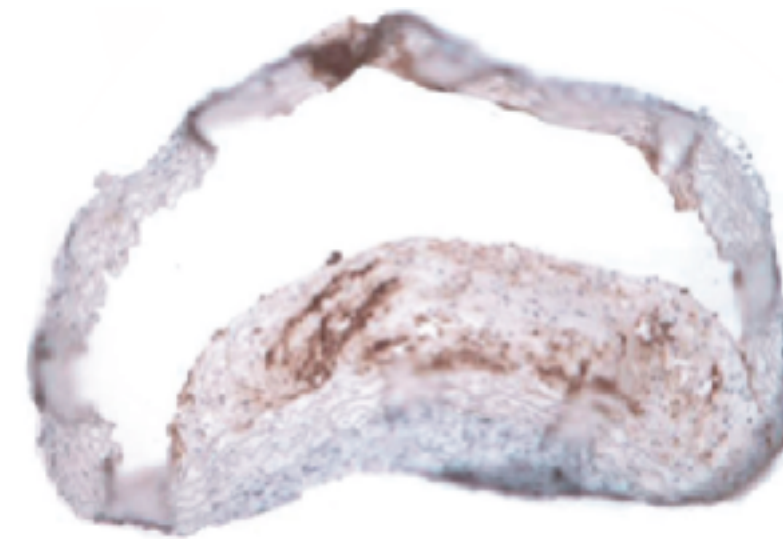


<https://www.npr.org/2018/02/06/583456129/black-lung-study-biggest-cluster-ever-of-fatal-coal-miners-disease?t=1561556701260>

Stroke and heart infarction from cardiovascular effects (here: PM_{2.5})



Clean air,
healthy food



Clean air,
fatty food

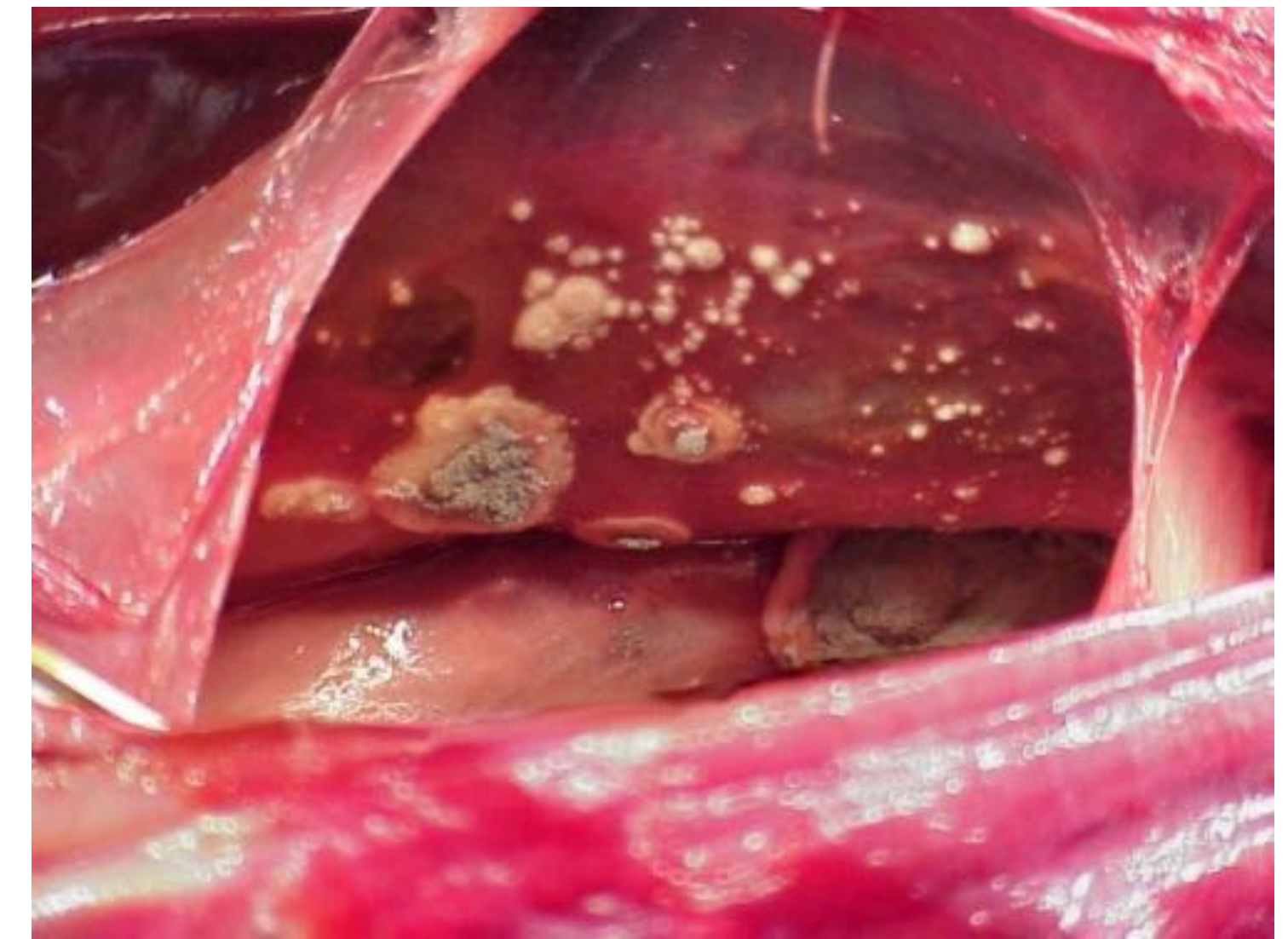


polluted air,
fatty food

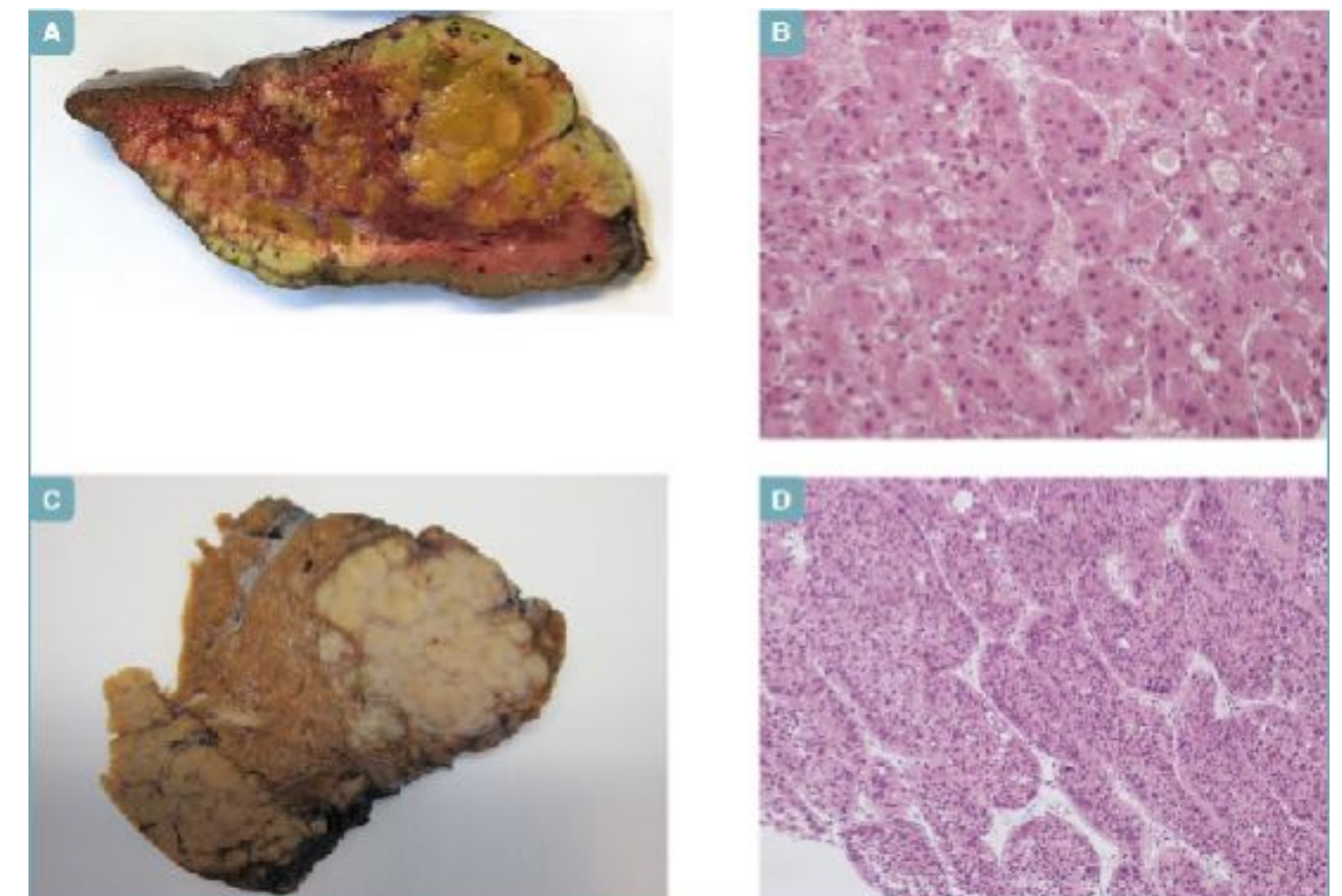
Atherosclerosis in rodents after six months of exposure to New York ambient PM_{2.5} (same level as in the city) and a high-fat diet.

Sun et al, JAMA Dec 2005

Infections (here: Aspergillosis)



http://www.michigan.gov/dnr/0,4570,7-153-10370_12150_12220-26360--00.html



DOI: <https://doi.org/10.32074/1591-951X-295>

Cancer (here: detoxification organ liver)

Skin and eyes are also direct targets

Spray: Pixabay.com



Staub im Gesicht: Pixabay.com



Ekzem: By James Heilman, MD - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=40647837>

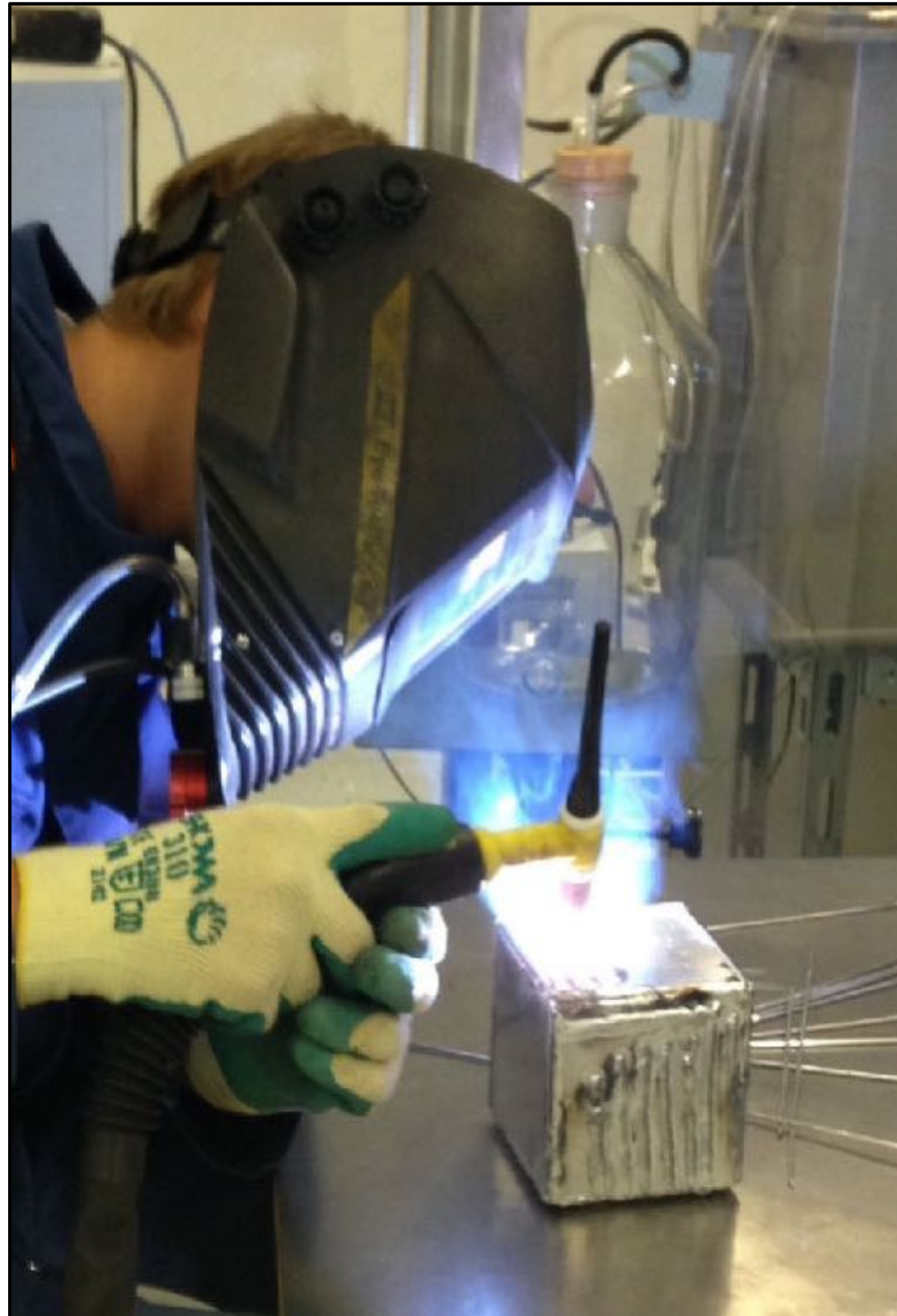
Public Domain picture, P33tr at [English Wikipedia](https://en.wikipedia.org/)

Release and transfer

Release
=
f (Process,
Medium,
Energy)



Visibility affects behaviour



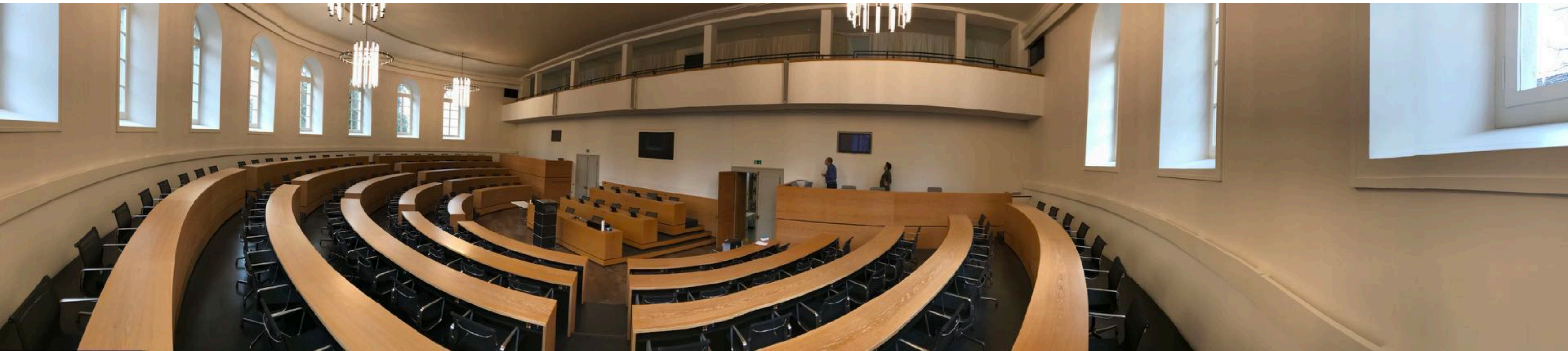
«Gas metal arc welding is clean»

WRONG!

Gas metal arc welding
creates predominantly
invisible nanoparticles

**How about the inverse?
Can we change behaviour by
making aerosols visible?**

Fog commonly used to assess performance of ventilation





How does the ventilation perform?



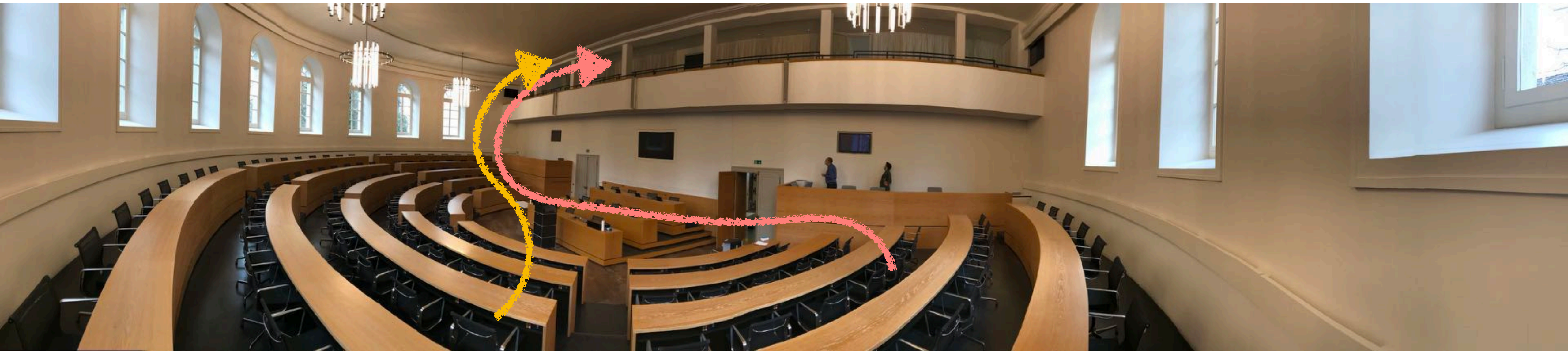
Transport is sideways

Aerosol slowly flow with the air

No diffusion, dispersion by Eddies

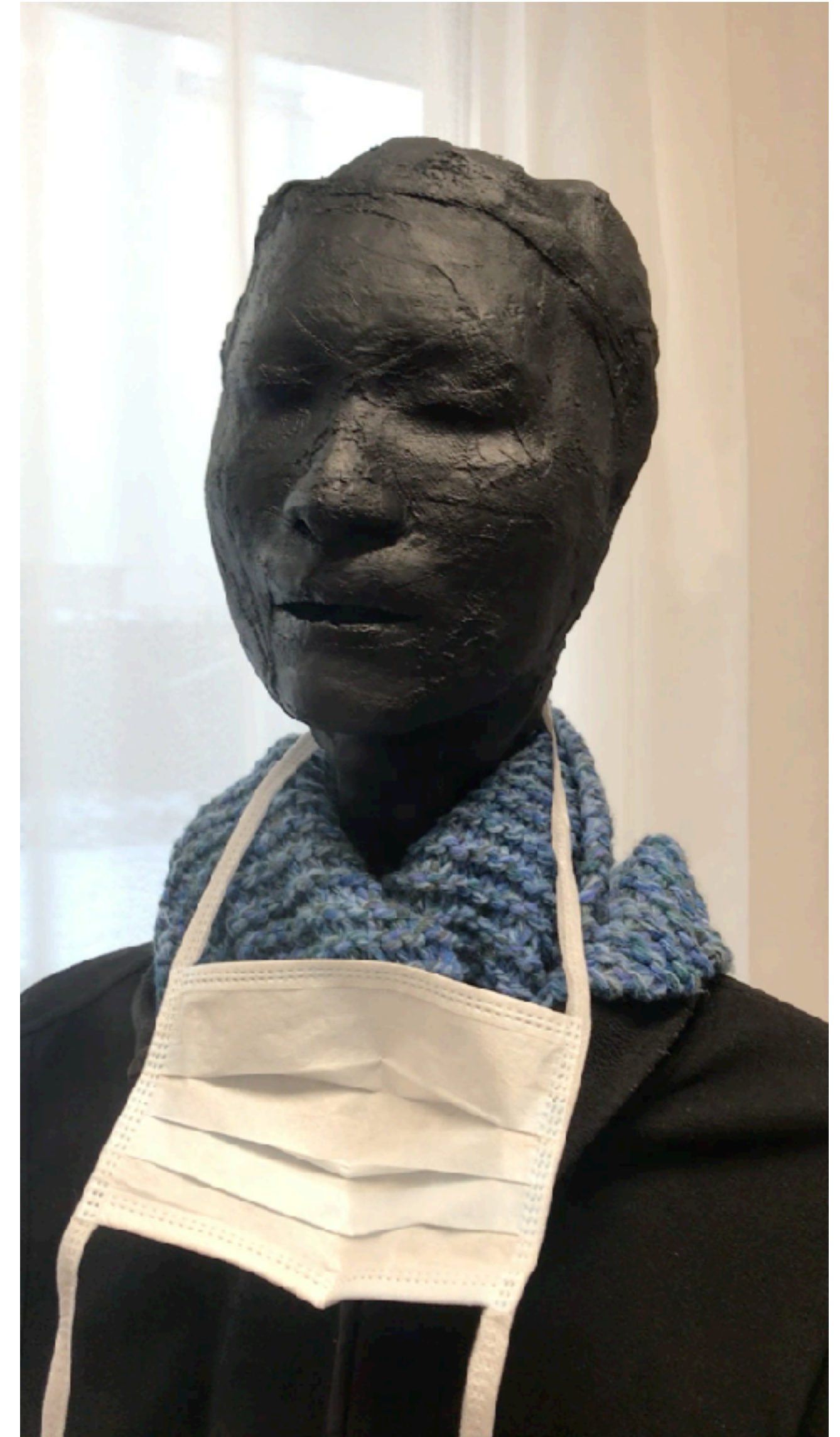
How does the ventilation perform?

Not as expected!



Temperature difference of 0.5°C

How to visualize exhaled aerosols?



Great for explaining on TV!



In a train



In a lift

Underlined texts are links to websites



In a ski lift cabin



In a school

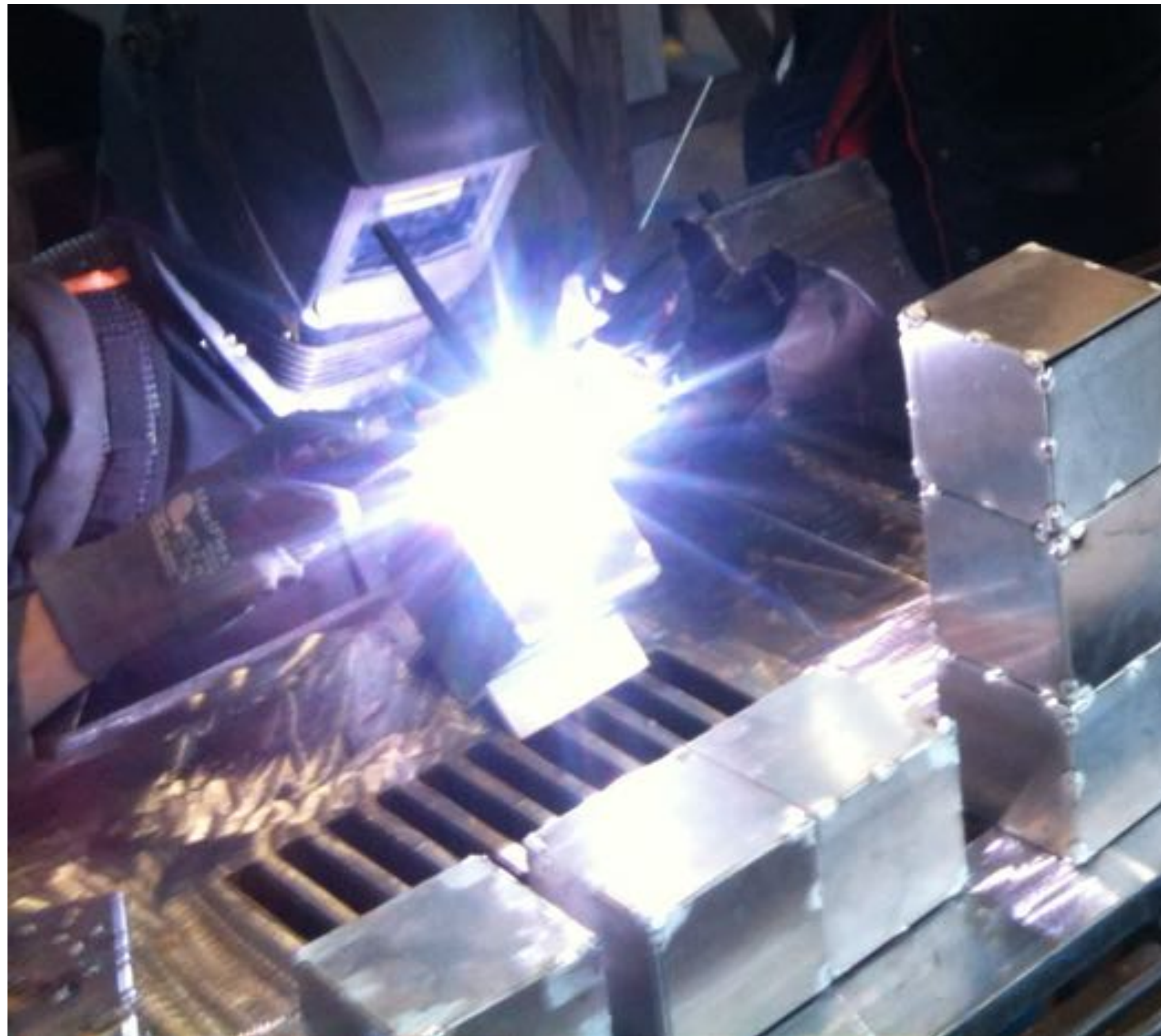
Five approaches to cut the path from source to effect.

1) Prevent release



2) Remove aerosols

Where could there be a problem?



Hot air rises. The gases are
The exhaust air draws downwards...

Suction arms on the ceiling, not above the workpiece!



3) Dilute and blow away the aerosols



5 minutes later



Blow away works well, but where does it go?

4) Prevent inhalation



See on TV [Underlined text is link to a website](#)

4) Prevent inhalation



4) Prevent inhalation



5) Reduce the frequency of inhalation



Spend the least possible time near aerosol-forming processes!

Take home message

- Aerosols are a huge health challenges at the workplace
- Occupational hygiene strategy addresses sources, transfer & uptake
- Theatrical fog useful to study transfer and a great didactical tool

SCOEH

Schweizerisches Zentrum für
Arbeits- und Umweltgesundheit

Thank you!

Questions?

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About the speaker

Occupational and environmental hygienist

- Studies and DSc in Environmental Hygiene at ETH Zürich
- MAS Work and Health (Occupational Hygiene) at ETH Zürich and Uni Lausanne

Expertise: Link release & exposure to health & risk management

- Since 1996 research on health risk & management related to aerosols (pollen, spores, pollutants, nanoparticles, etc.), gases, noise and heat
- Teaching of hygiene, risk analysis and risk management at Uni Lausanne (PD, till 2015) and NTU Singapore (A.A. Prof., till 2021)

SCOEH: Swiss Centre for Occupational and Environmental Health

- 2018: Foundation of SCOEH as independent research centre
- Research, teaching and consultancy in field of expertise
- Riskmapping to integrate work and health into management processes

