Preparing for the Next Pandemic: Research-Based Solutions

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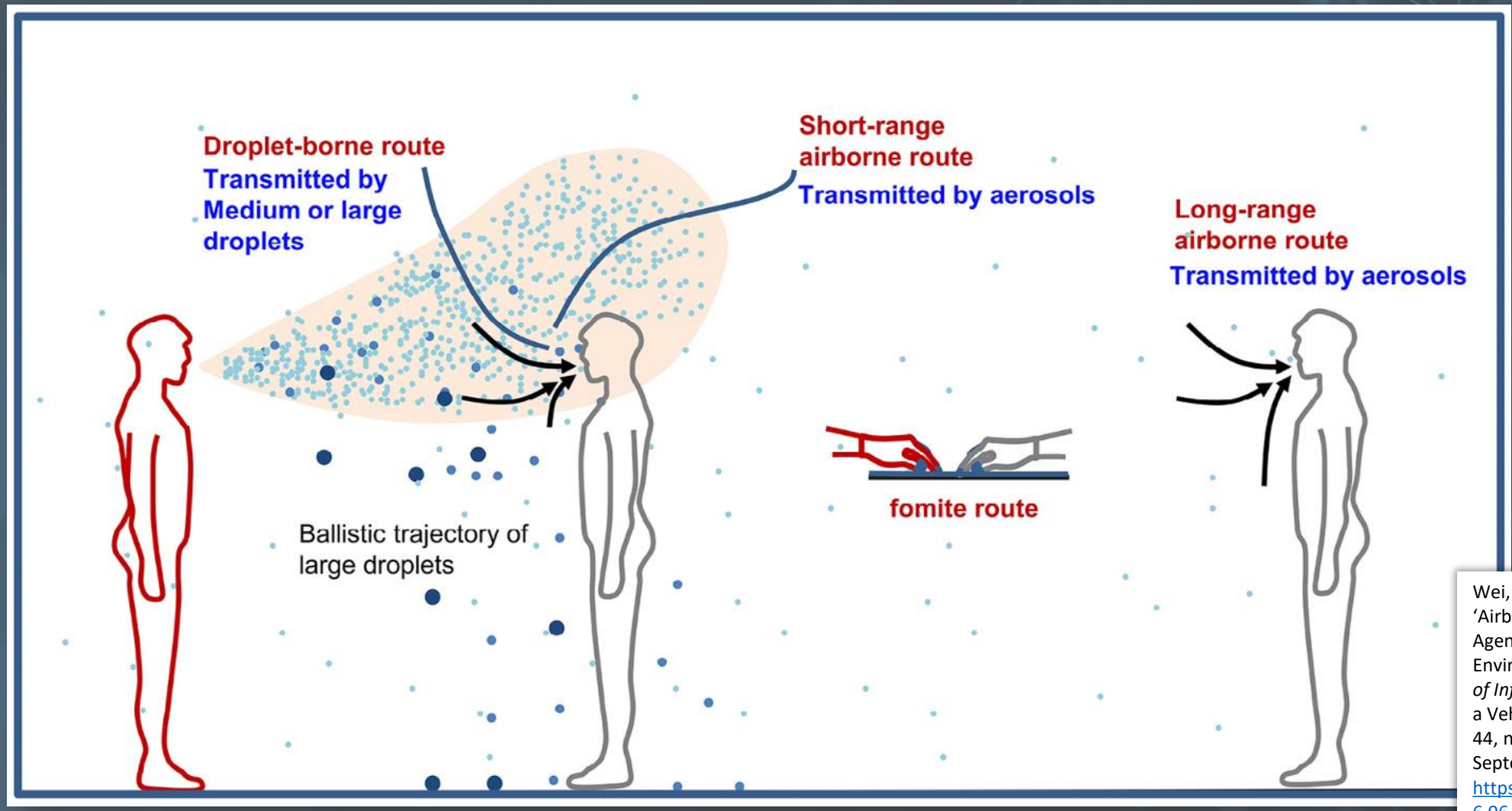
Topics for Today

Background
E3 Project
Applications – Examples
CFD Simulations – Examples
Take-Home Message

Background

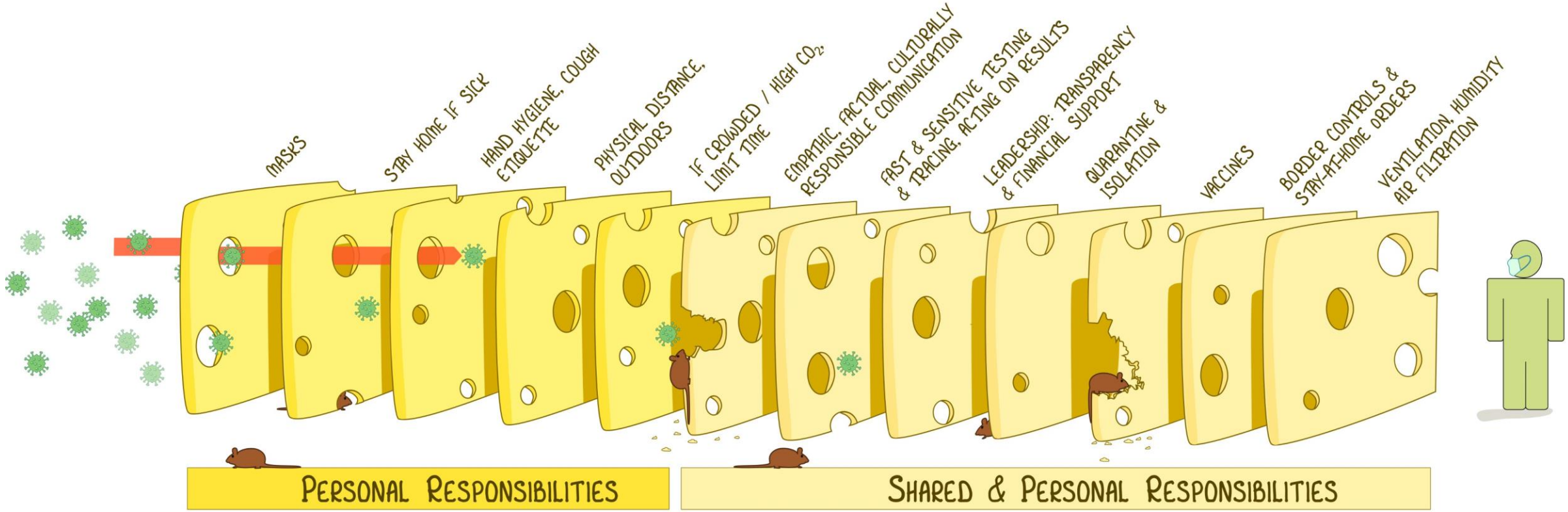
Routes of Transmission (for example SARS-CoV-2)



Wei, Jianjian, and Yuguo Li. 'Airborne Spread of Infectious Agents in the Indoor Environment'. *American Journal of Infection Control*, Indoor Air as a Vehicle for Human Pathogens, 44, no. 9, Supplement (2 September 2016): S102–8. https://doi.org/10.1016/j.ajic.2016.06.003.

The Swiss Cheese Respiratory Virus Pandemic Defence

Recognising that no single intervention is perfect at preventing spread

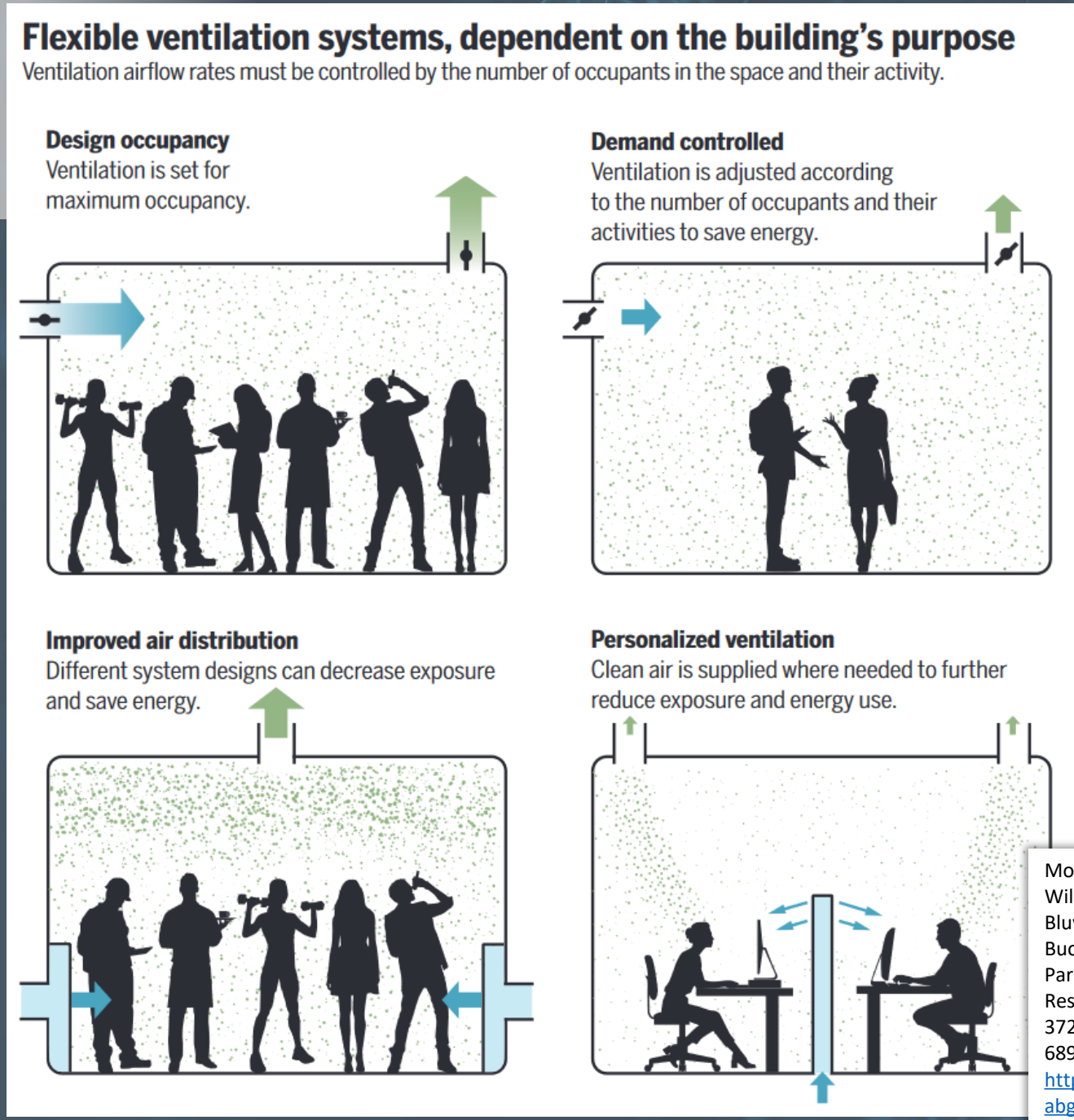


Each intervention (slice) has imperfections (holes) which change in size, number and position depending on how the intervention is rolled out.
Multiple layers improve success.

Misinformation mouse

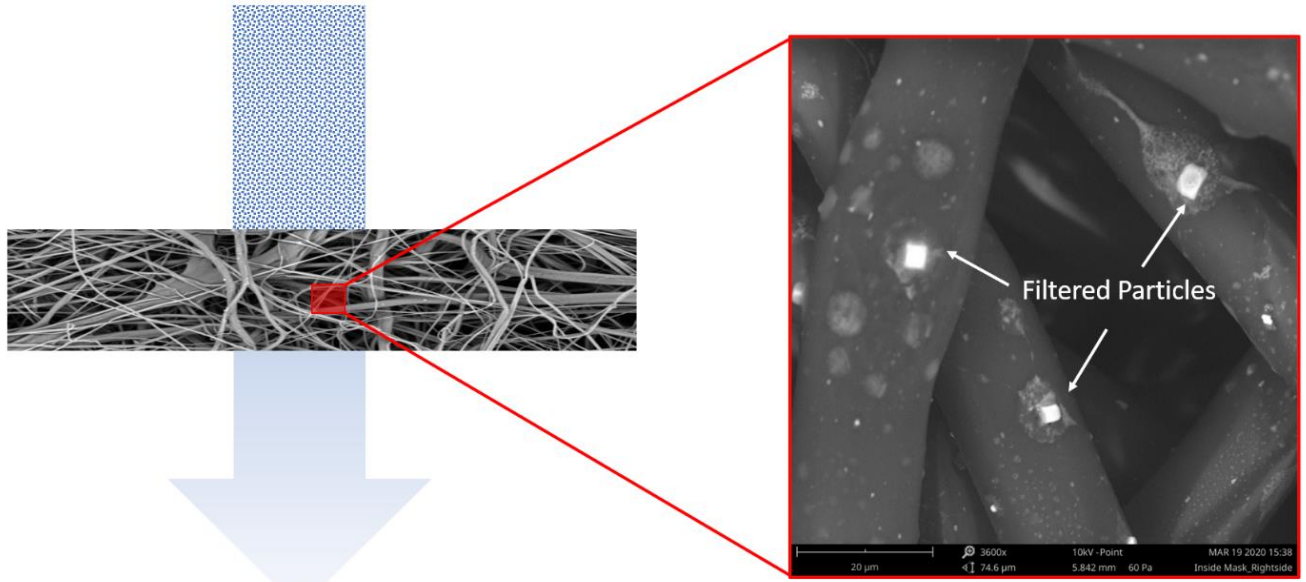
Ian M Mackay
virologydownunder.com
With thanks to Jody Lanard, Katherine Arden & the Uni of Qld
Based on the Swiss cheese model of accident causation, by James T Reason, 1990
version 4.3
Update: 04SEP12021

Ventilation

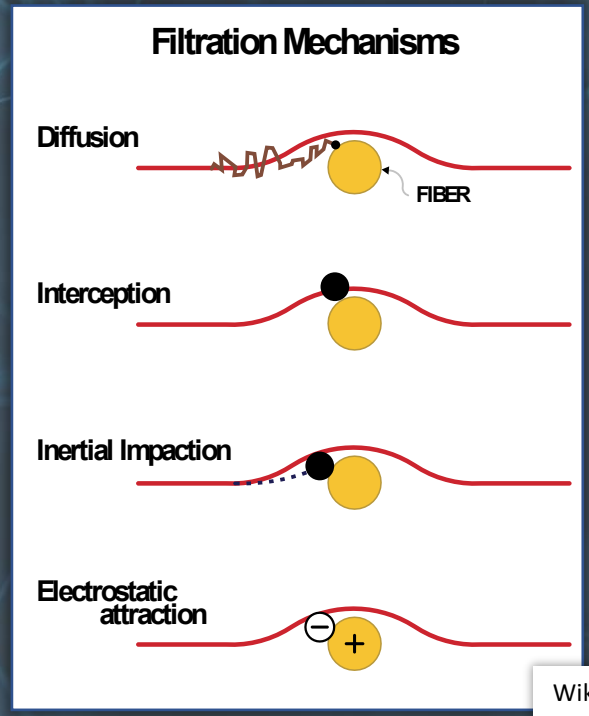


Morawska, Lidia, Joseph Allen, William Bahnfleth, Philomena M. Bluyssen, Atze Boerstra, Giorgio Buonanno, Junji Cao, et al. 'A Paradigm Shift to Combat Indoor Respiratory Infection'. *Science* 372, no. 6543 (14 May 2021): 689–91. https://doi.org/10.1126/science.abg2025.

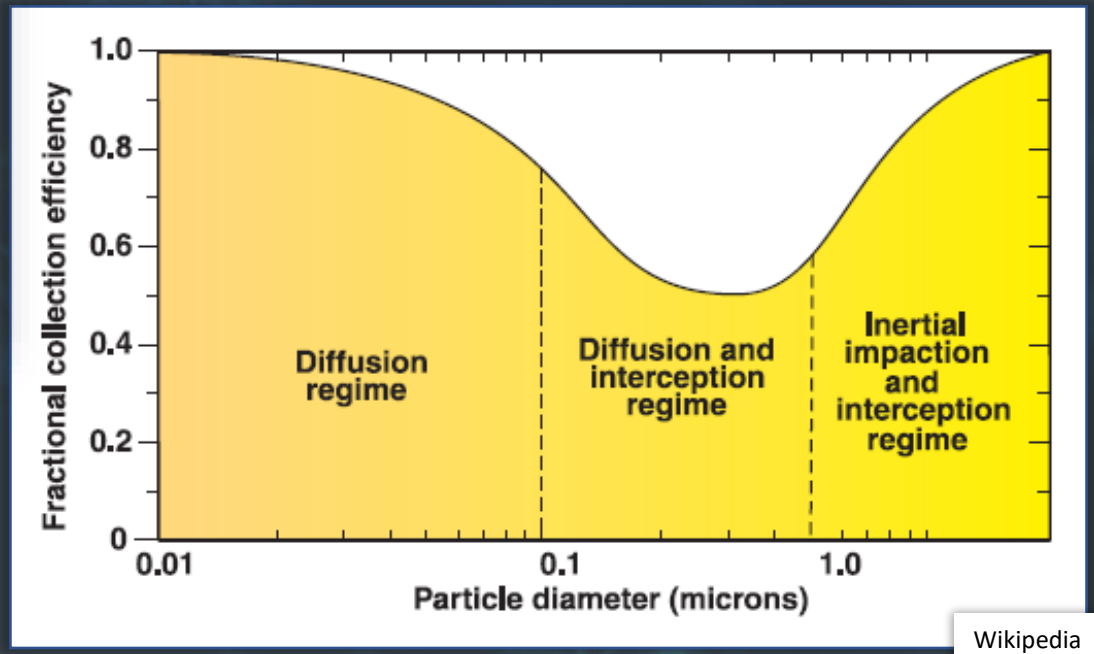
Air Purifiers (Filters)



https://www.nanoscience.com/applications/materials-science/effectiveness-of-masks-fast-answers-with-automated-sem-analysis/



Wikipedia



Wikipedia

E3 Project

www.pandemicresponse.fi

THE E3 PROJECT ECOSYSTEM

Science-based world-class solutions to global markets with high business and societal impact.

Use cases as a platform for joint development of need-based solutions focus on pandemics:

Use Case 1: Smart Modular Healthcare
Use Case 2: Smart Office
Use Case 3: Dynamic interaction of people and indoor environment

Multidisciplinary joint research

WP1 Risk Assesment, Prevention & Control Strategies

WP2 Pathogens & Human Being

WP3 Emissions, Dispersion, Deposition & Exposure

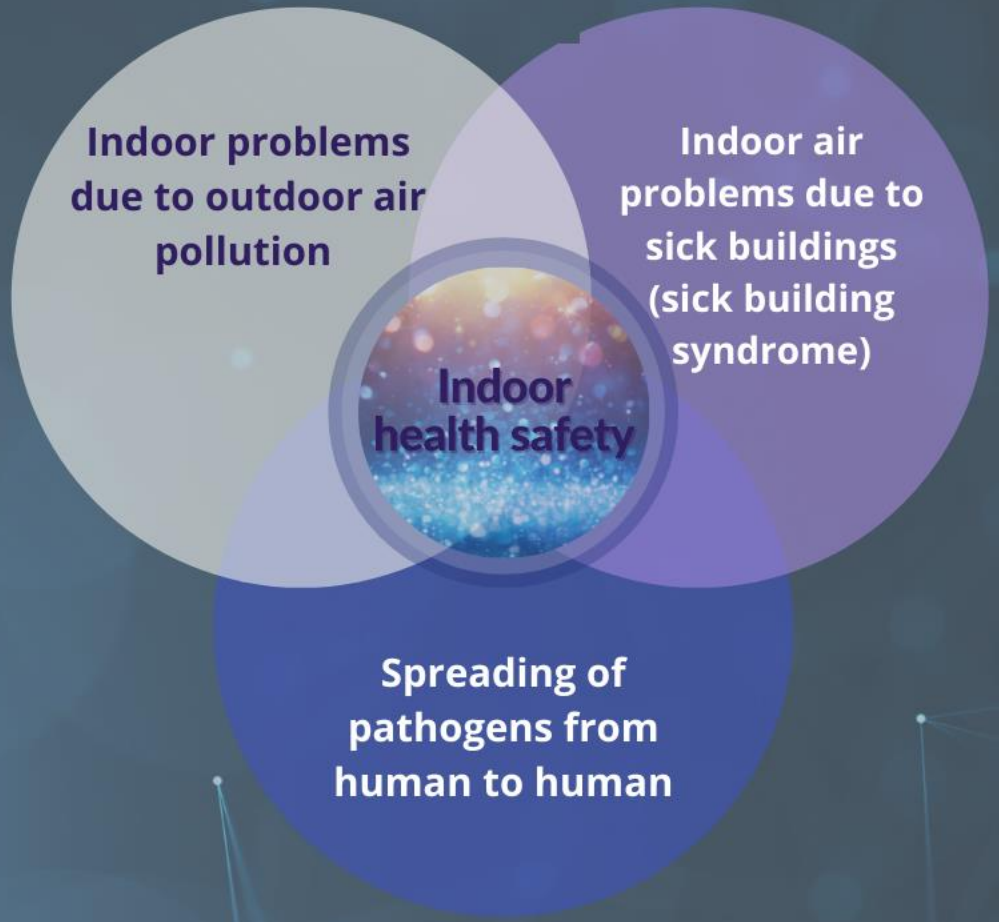
WP4 Detection & Monitoring & Diagnostics

WP5 Airborne Contamination Control

WP6 Integration of Indoor Concepts & Solutions

WP7 Project Coordination & Coordination of Business Cooperation

www.pandemicresponse.fi



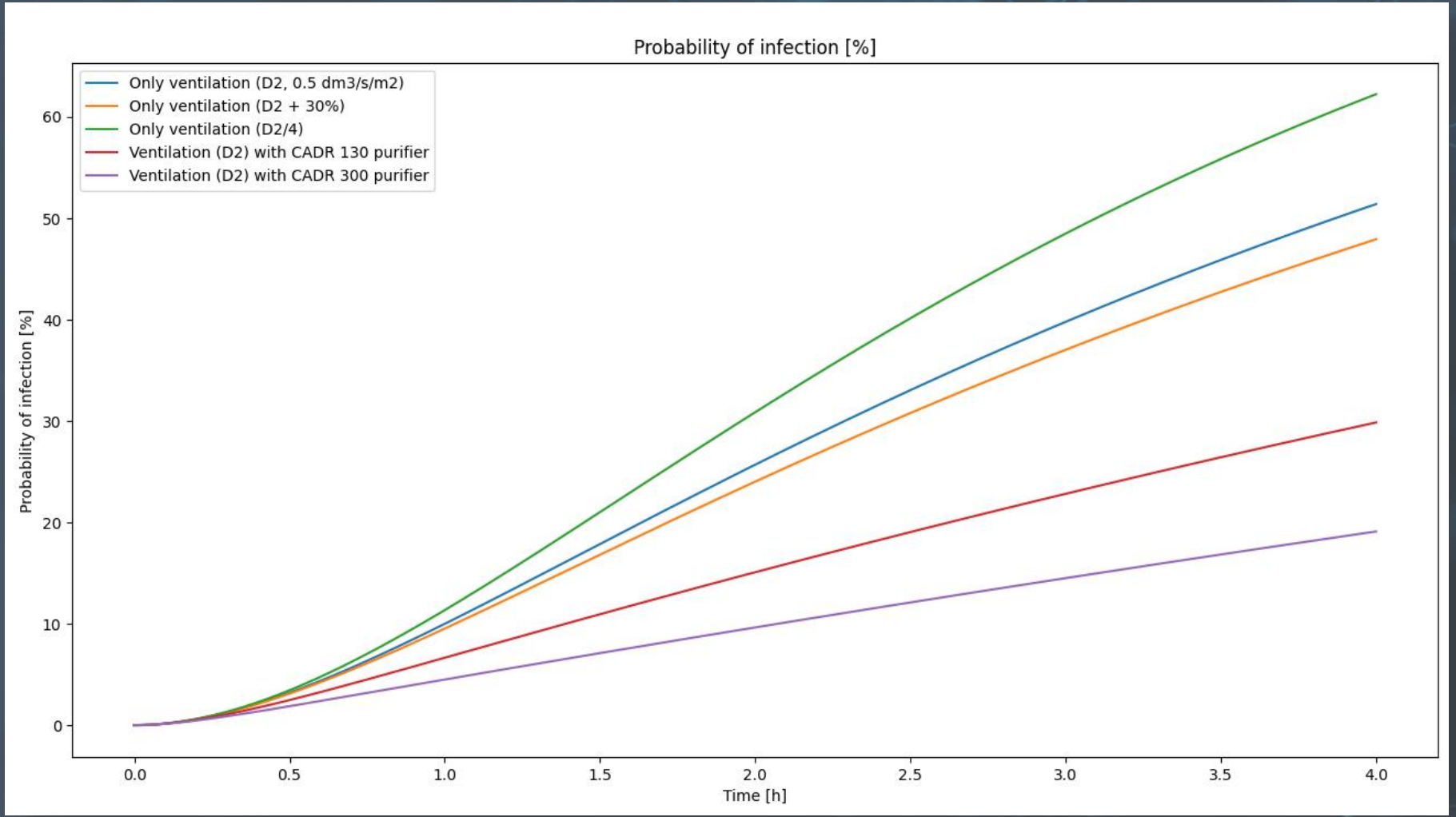
The project may initiate a new field business: Indoor Health Safety

Substance roles of the E3 companies

Applications – Examples

Example: Singing at Home

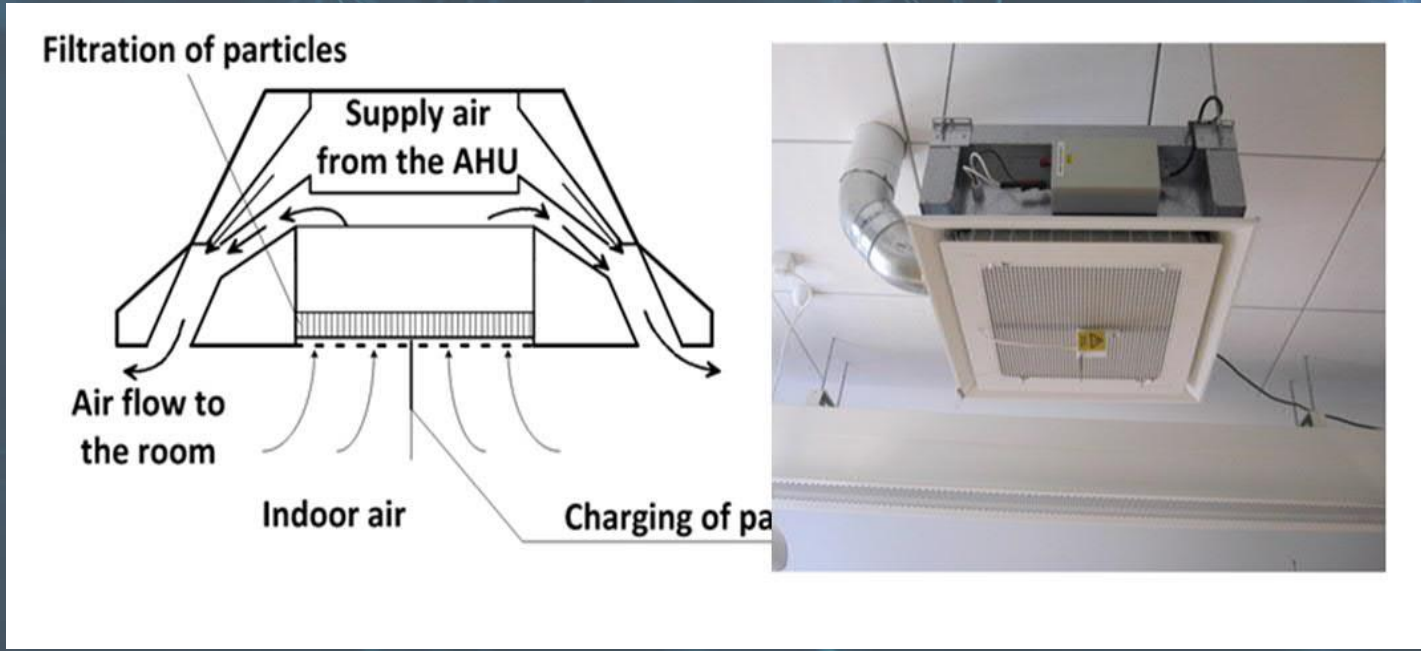
Room area: 25 m^2
Room height: 2.7 m
Emission rate: 62 quanta/h
Deposition rate: 0.24 h-1
Inactivation rate: 0.63 h-1
Breathing rate 6.0 dm^3/min



Example: An air purification concept for significant improvement of indoor air quality

Combining high quality supply air filtration and effective room air filtration

- 90 % reduction of particle concentration compared to existing technology without major changes to the ventilation system
- Applications: offices, hotels, public buildings, production facilities, homes, etc.



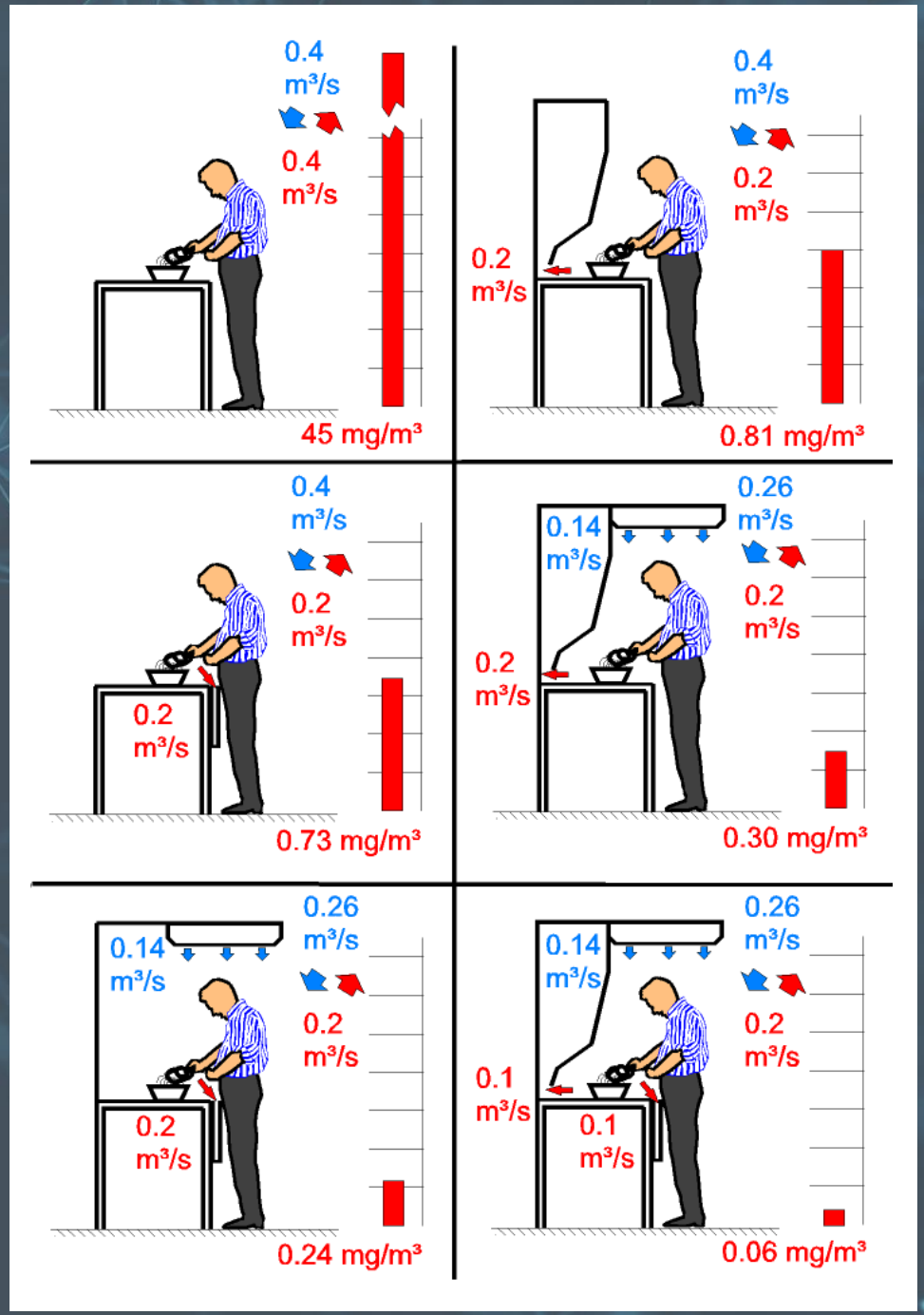
Example: Local Ventilation

Test conditions:

- General ventilation only
- Local exhaust
- Local supply & exhaust

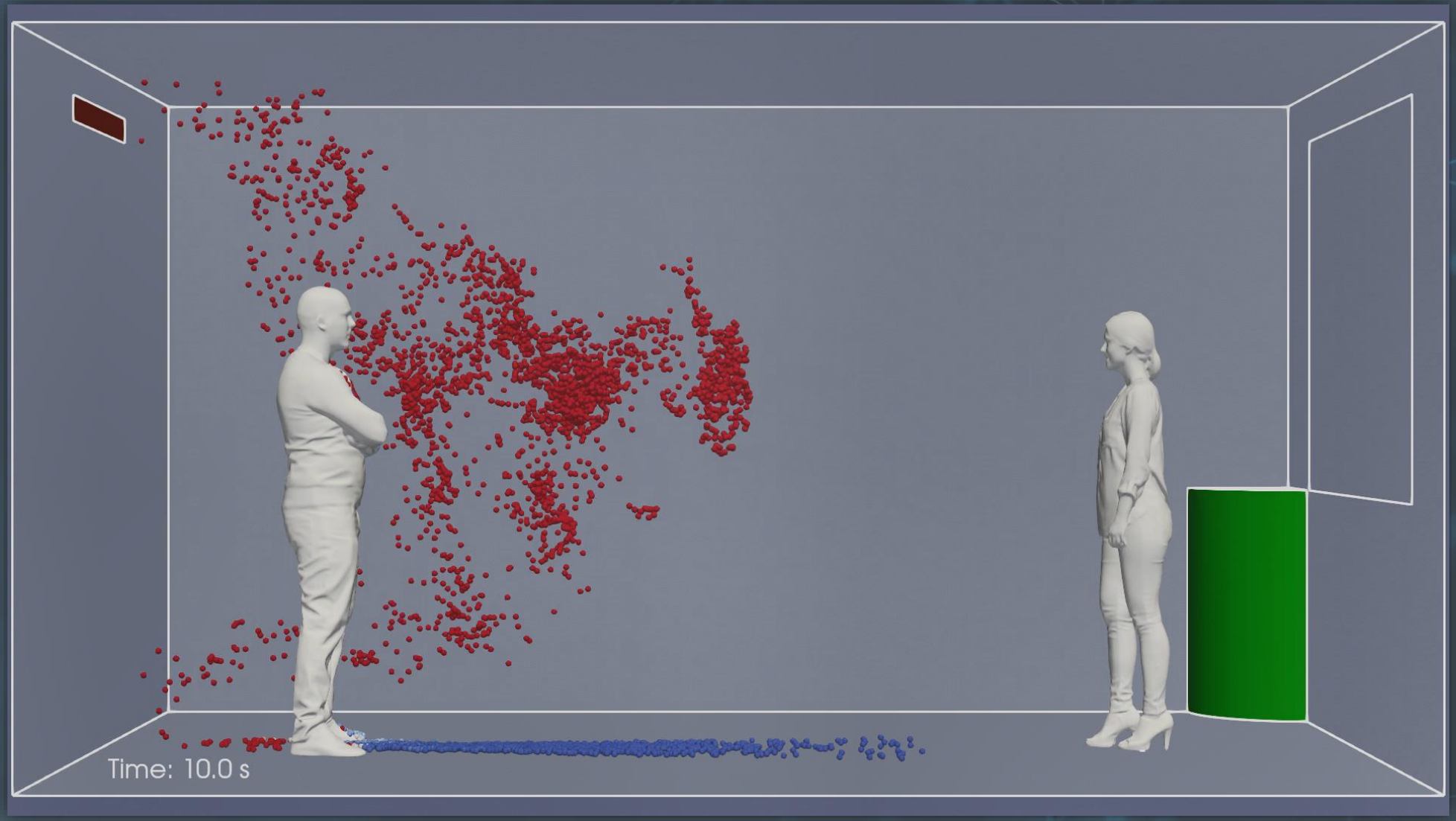
Exposure reduction:

45 → 0.06 mg/m³

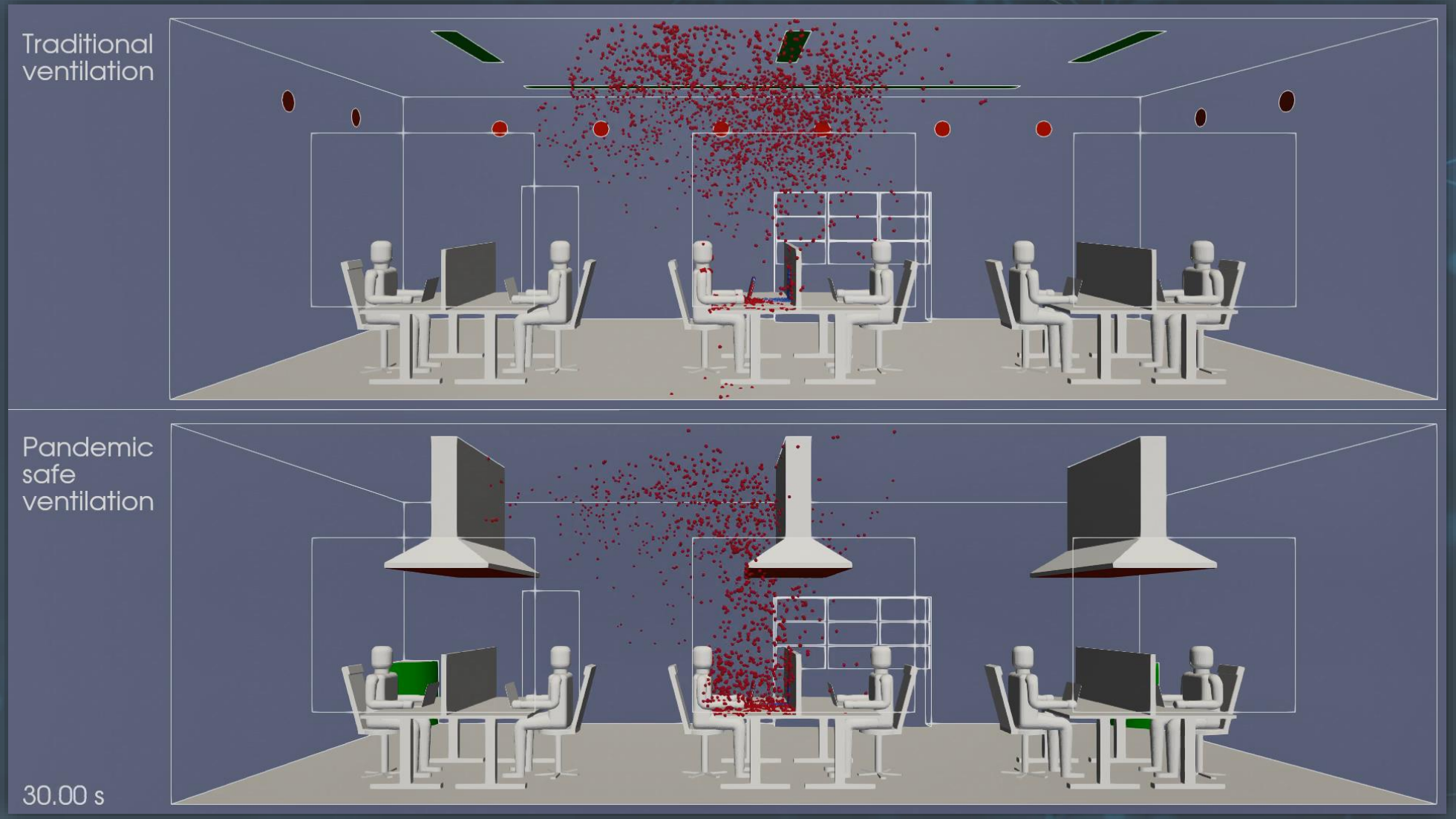


CDF Simulations – Examples

Example: Coughing Person in Room Ventilated with Displacement Ventilation

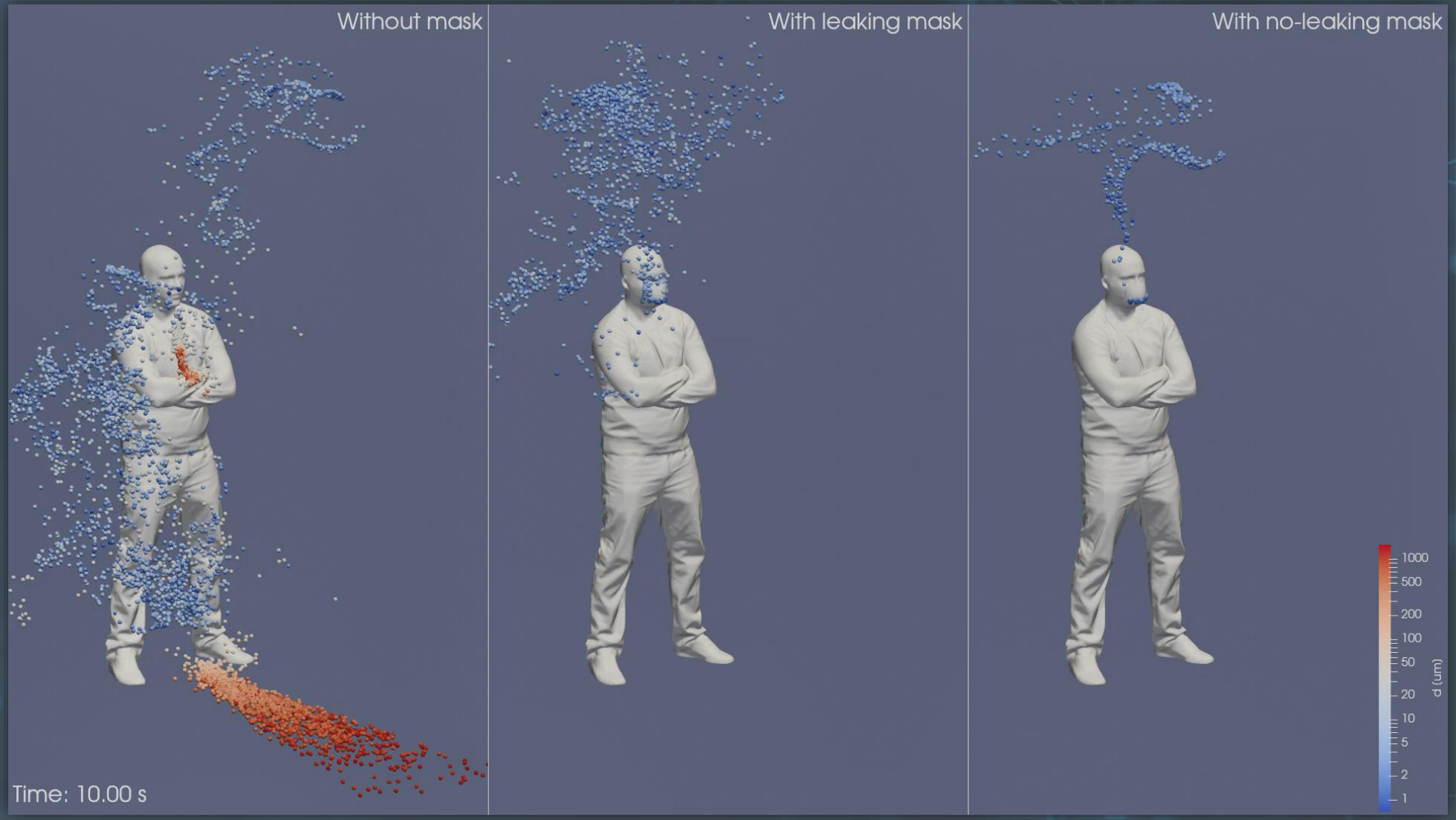


Example: Traditional vs. Pandemic Safe Office



Example: Effect of Purifier, Purifying Air Diffuser and Ventilation Method

Example: Effect of Typical Mask



Take-Home Message

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Research-based solutions can help us out of the current pandemic and help to prevent the next one

THANK YOU

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CleverHealth Network

INDOOR AIR QUALITY ECOSYSTEM

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