

# Integrated particle generation protocol for in vivo/vitro studies: emissions from diesel engine, wood combustion, cooking, and cleaning products

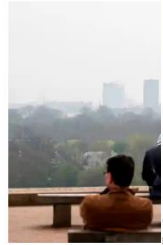
Dawei Hu<sup>1</sup>, Aristeidis Voliotis<sup>1</sup>, Daniel Bryant<sup>2</sup>, Marvin Shaw<sup>2</sup>, Jacqui Hamilton<sup>2</sup>, Gordon McFiggans<sup>1</sup>

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## theguardian

Air pollution linked to much greater risk of dementia

Risk in over-50s increases by levels exist, study shows



King's College London study could not be... Photograph: Adrian Dennis/AFP/Getty Images

Air pollution may increase the risk of dementia, suggested, in fresh evidence from breathing dirty air.

## Air pollution damage to lungs is irreversible



Kamal Narayan Omer  
@KamNarayanOmer  
@20th November 2017

Every year the third Wednesday of November is observed as World No Tobacco Day. It is a day to raise awareness on the condition, risk factors and also on the need for a smoke-free environment for healthy living. The COPD theme this year is 'Lungs - Never More Important' as the Covid 19 infection has shown how environment and human life but also compromised our lungs. It is most certainly now before it is too late.

## THIS could increase YOUR heart attack risk - and it's NOT blood pressure or cholesterol

HEART DISEASE - a condition which can increase the risk of heart attack and stroke - is usually linked to high blood pressure, high cholesterol or lack of exercise. But now experts believe it could be caused by tiny particles in air pollution.

By OLIVIA LERCHE  
14:07, Wed, Apr 26, 2017 | UPDATED: 15:04, Wed, Apr 26, 2017



Presenter: Dawei Hu

The health cost of burning wood to warm homes is not cheaper or truly renewable health risk

Diesel engine pollution linked to early deaths and costs NHS billions

## Cooking Sunday roast causes indoor pollution 'worse than Delhi'

Scientists say roast meal can make household air dirtier than in sixth most polluted city



Tests during cooking showed PM2.5 levels rose to 200 micrograms per cubic metre for one hour, more than the 143 micrograms averaged in Delhi. Photograph: Suzanne Plunkett/Reuters

10th percentage of diesel cause quarter of all air



London. Air pollution experts warn of the link Photograph: Shaun Curry/AFP/Getty Images

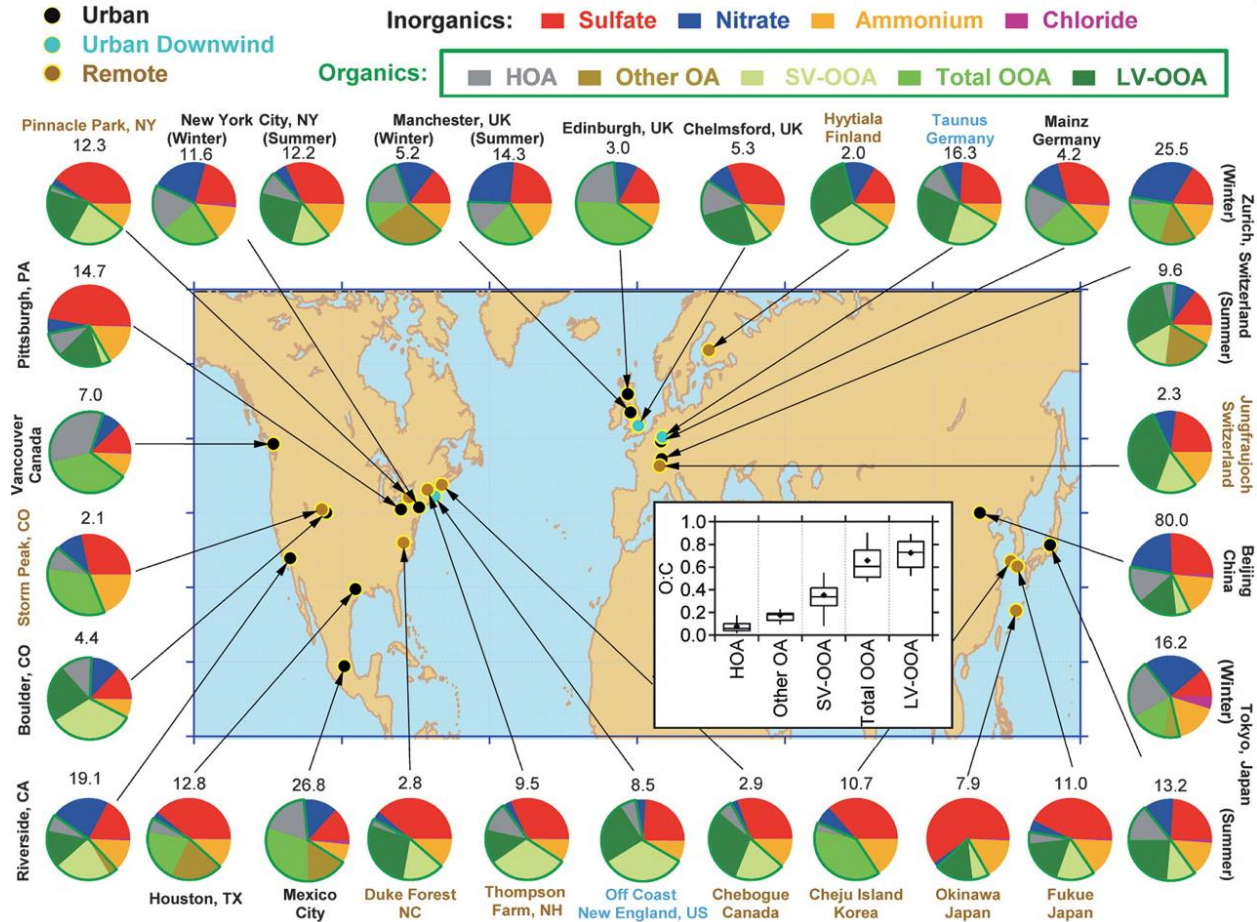


Photograph: PamWalker68/Getty Images/istockphoto

Air pollution is considered to be one of the world's largest environmental health threat, accounting for **7 million deaths** around the world every year (*WHO, 2021*)

### in vivo/vitro studies

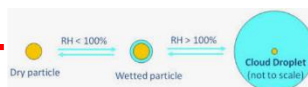
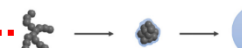
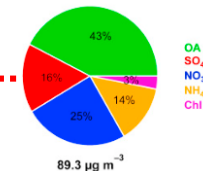
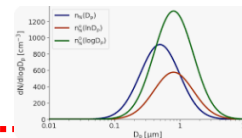
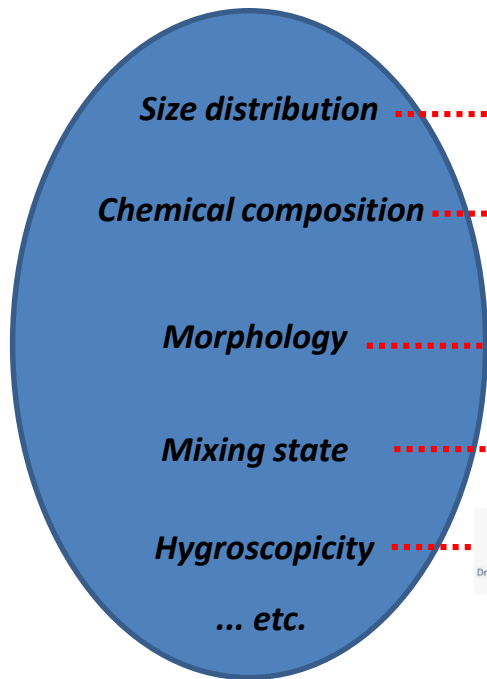
- Dose: PM mass conc.
- Chemical dependent
- **Reality: Complex emissions**



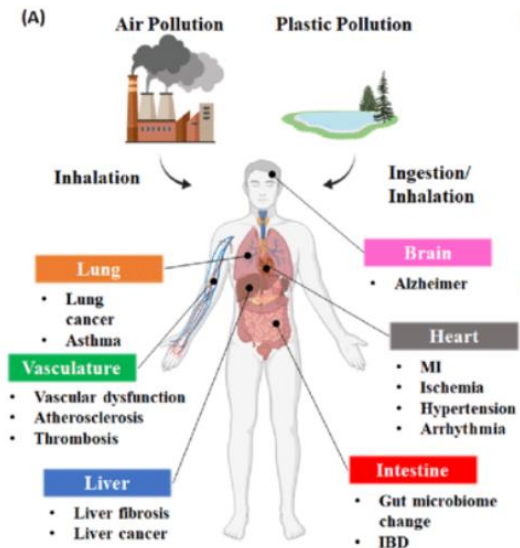
**Pollution sources**

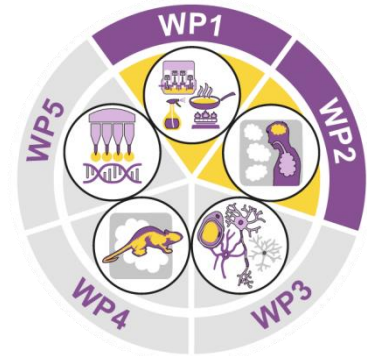


**Aerosol information**



**Health response**





**WP1**

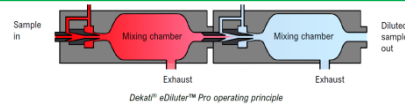
Projected exposure week	1-5	Diesel
	6-10	Clean air
	11-15	Woodsmoke
	16-20	Secondary organic aerosol
	21-25	Cooking emissions
	26-30	Clean air with NOx
	31-35	Woodsmoke with NOx



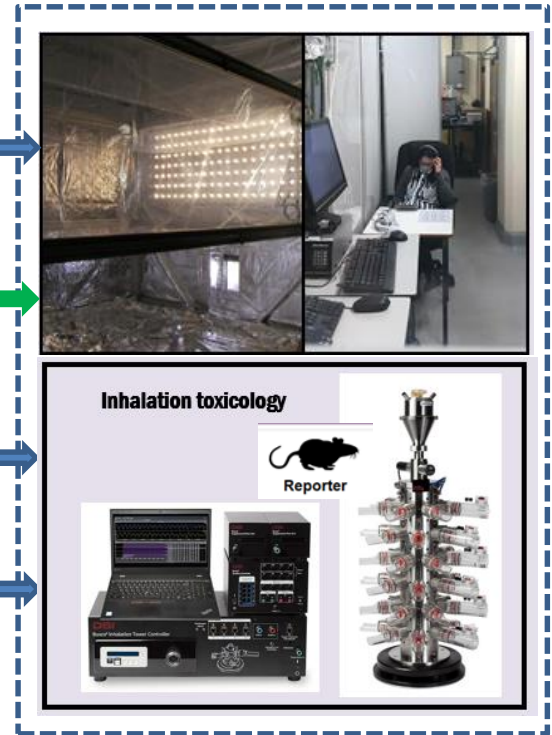
**Sources**



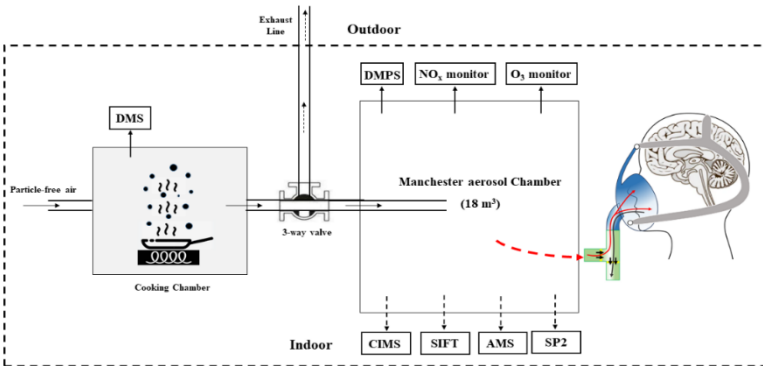
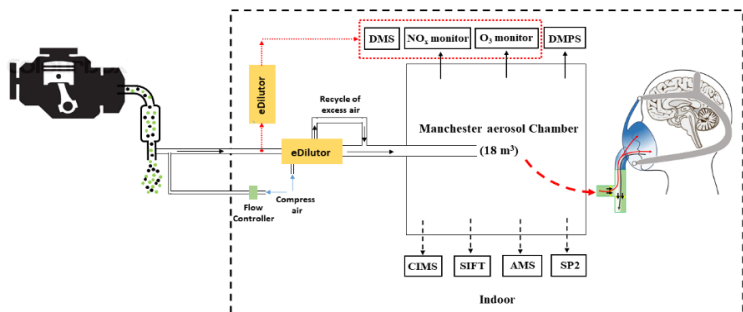
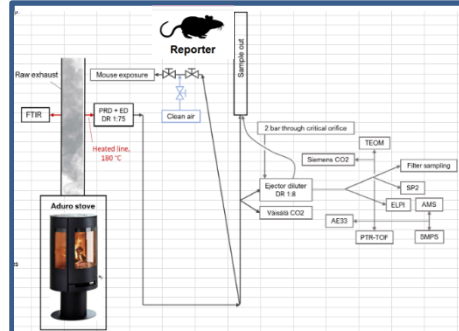
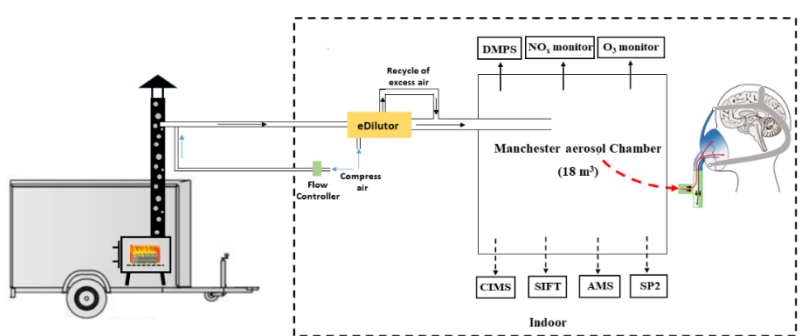
**eDiluter (Dekati)**



Blue arrow: **Injection directly**  
Green arrow: **Injection via eDilutor**



**Exposure experiment**



- Put the pan with 100 ml olive oil on the induction hob, Isolate cooking chamber (warm up 6 min)
- Blow emissions to the outside with clean air (2 min)
- 2 pieces of Pork in, Isolate cooking chamber (waiting for 4 min)
- Blow the emissions into MAC for 6 mins
- Switch off Induction hob and blow emissions to the outside with clean air (2 min)

Creating repeatable, fully characterised and safe exposure conditions

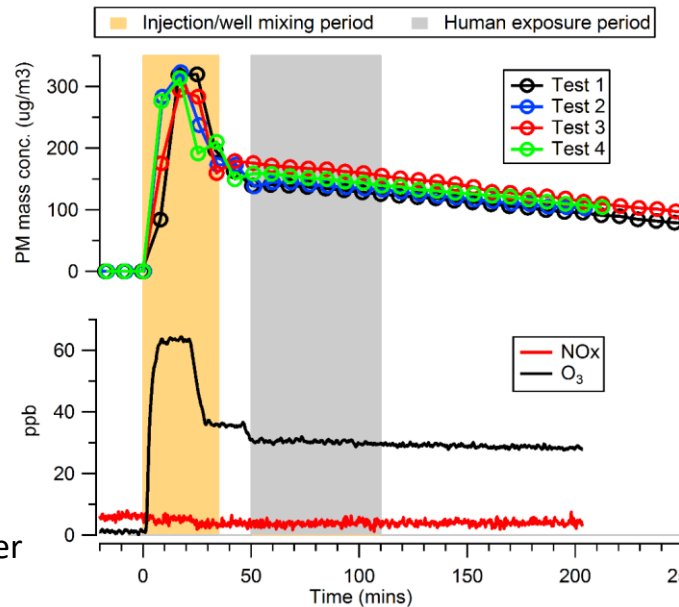
### Gas phase

- GC-MS
- SIFT-MS
- Iodide-HR-ToF-CIMS
- O<sub>3</sub>, NO<sub>x</sub>, CO

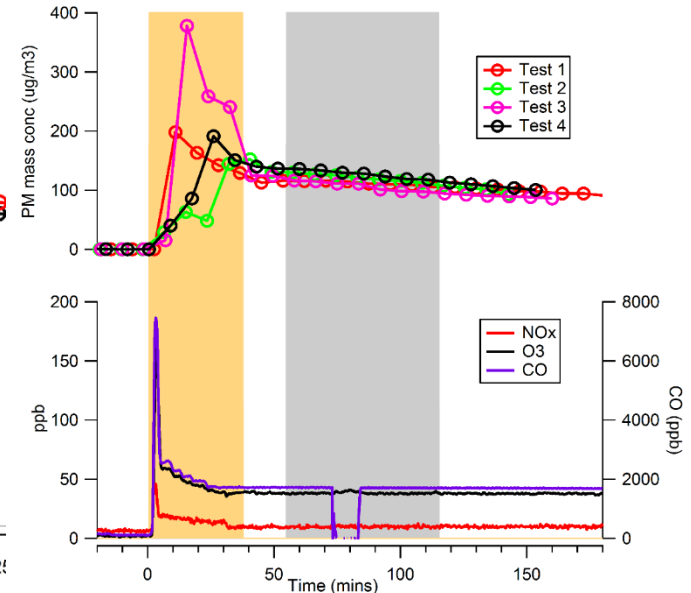
### Particle phase

- 2D-GC-MS
- LC-Orbitrap-MS
- FIGAERO-I<sup>-</sup>-HR-ToF-CIMS
- SMPS/DMPS
- C-ToF-AMS
- Aerosol Mass spectrometer
- Single particle soot spectrometer

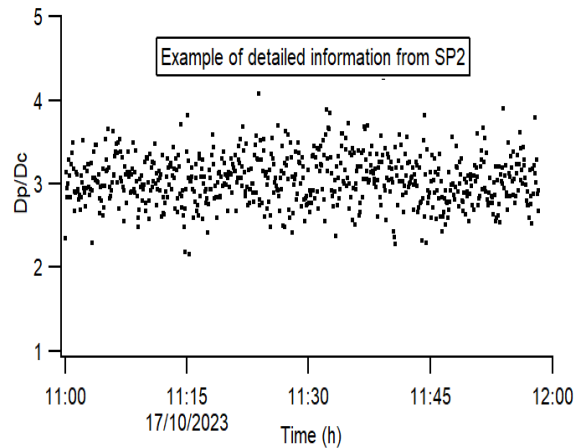
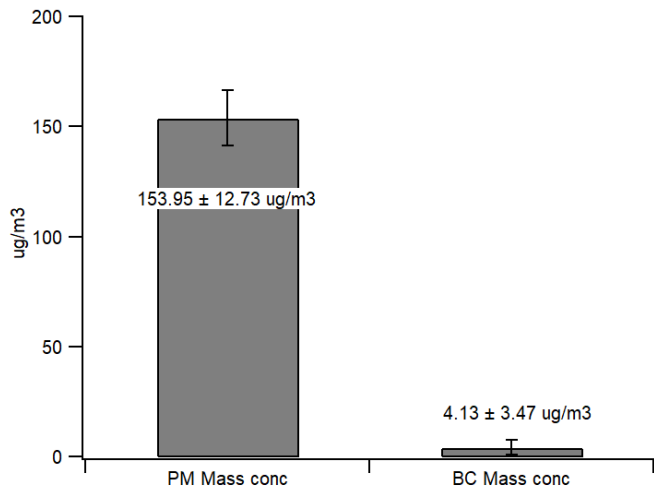
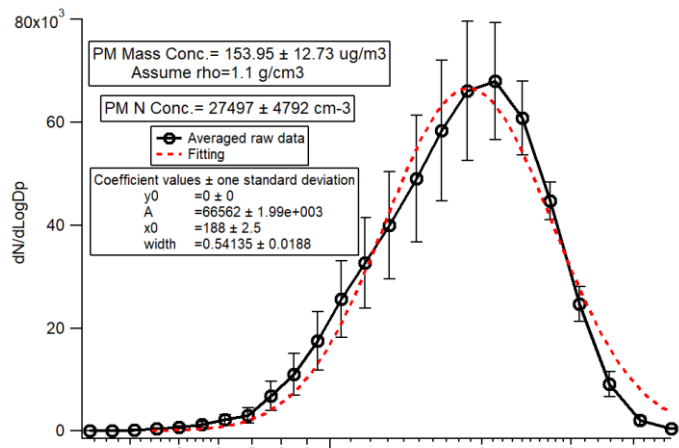
## Cooking (Pork chop fry)



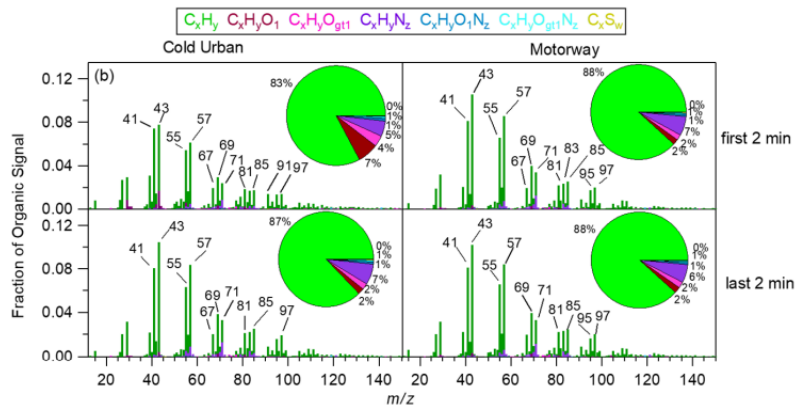
## Wood combustion



# Further physical and chemical information-Diesel engine emissions



**BC Coating Thickness  
SP2**



**Figure 3.** HR mass spectra and chemical composition: (a) during the first 2 and the last 2 min of a cold urban (left), hot urban (middle), and motorway (right) Artemis cycle for the gasoline GDI3 vehicle and (b) during the first 2 and the last 2 min of a cold urban (left) and a motorway (right) Artemis cycle for the diesel D3 vehicle.

**Chemical fomration (AMS/CIMS)**

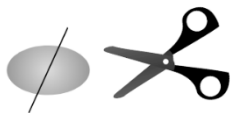
# In-vitro toxicology @ MAC

Developed by *Aristeidis Voliotis*

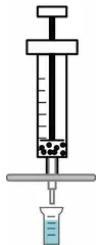
## Advancing in-vitro toxicology approaches

### Prepare filters.

Cut in half with sterilized scissors.  
Return ½ filter to freezer.



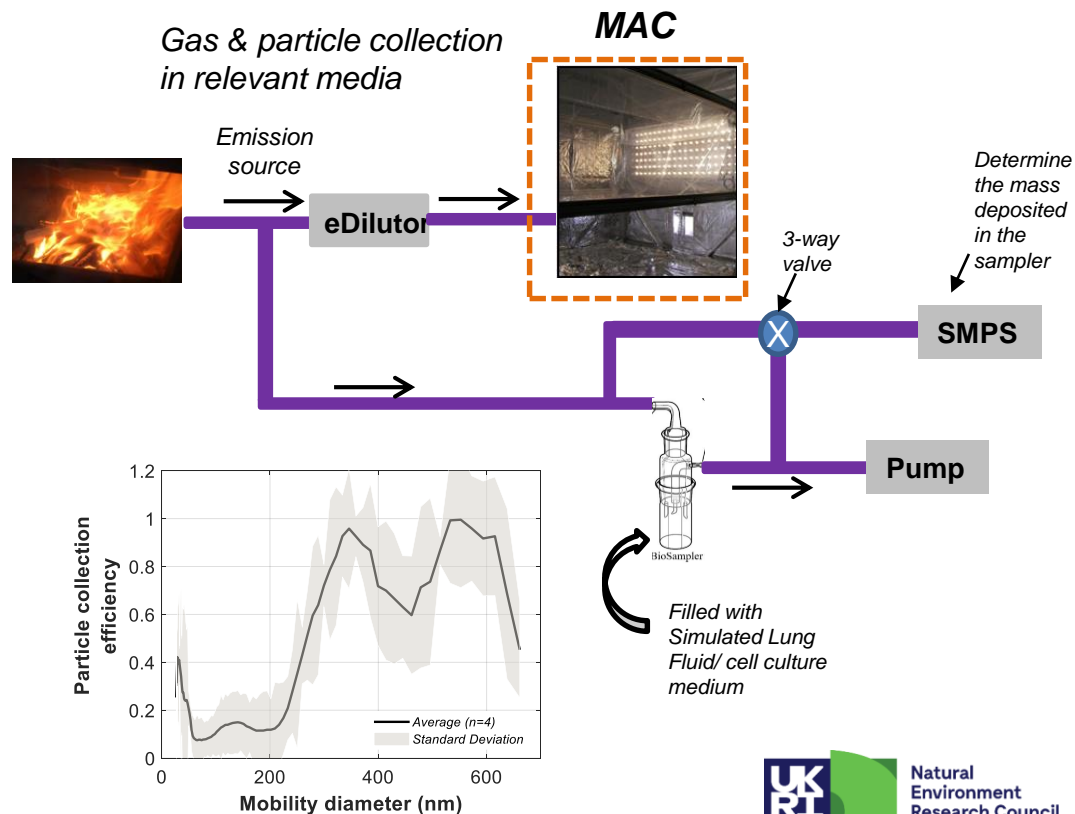
Extraction



Filtration

Use

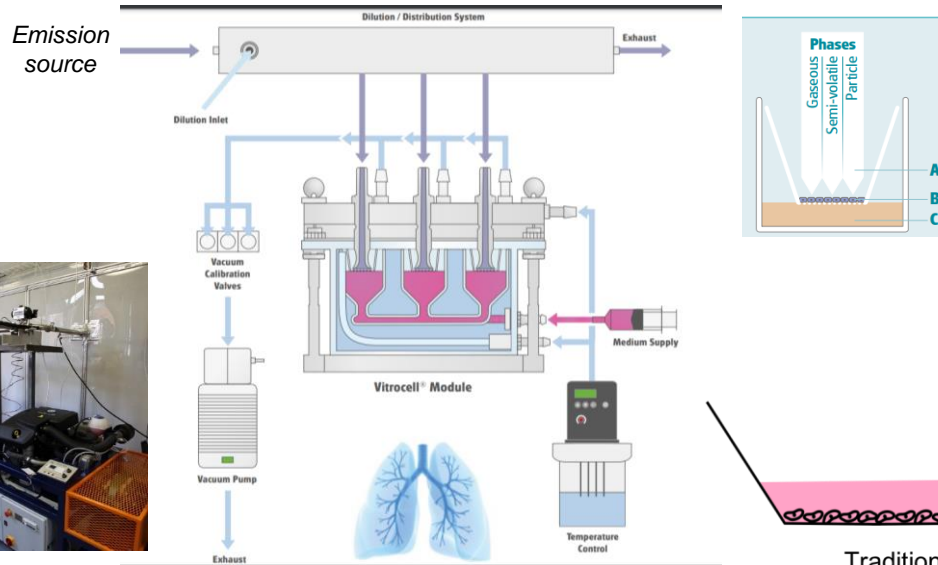
**This process alters PM physical and chemical properties!**





Work under development...

*Air-Liquid Interface*



Traditional (left) vs. 3D ALI (right) cell cultures.

***Thanks for your attention!***

***Any questions?***

***Contact information:***

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