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# Sources, behaviour and mitigation strategies influencing indoor air quality

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23rd September 2021

# Indoor air quality

- Average UK person spends 90% time indoor
- High exposure to indoor air pollutants:

  particulate matter

  volatile organic compounds

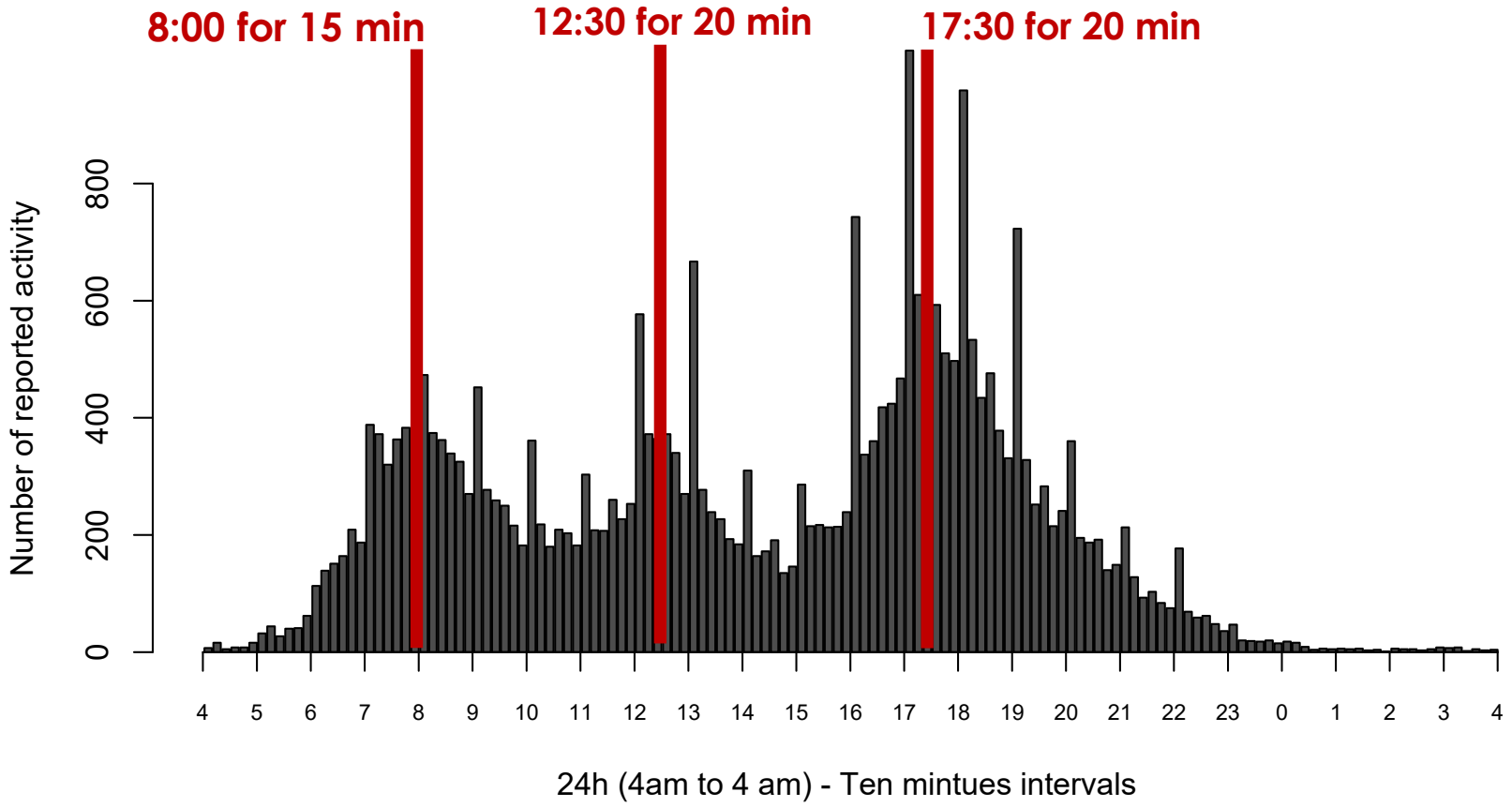
  carbon monoxide

  biological materials

# Sources of pollution

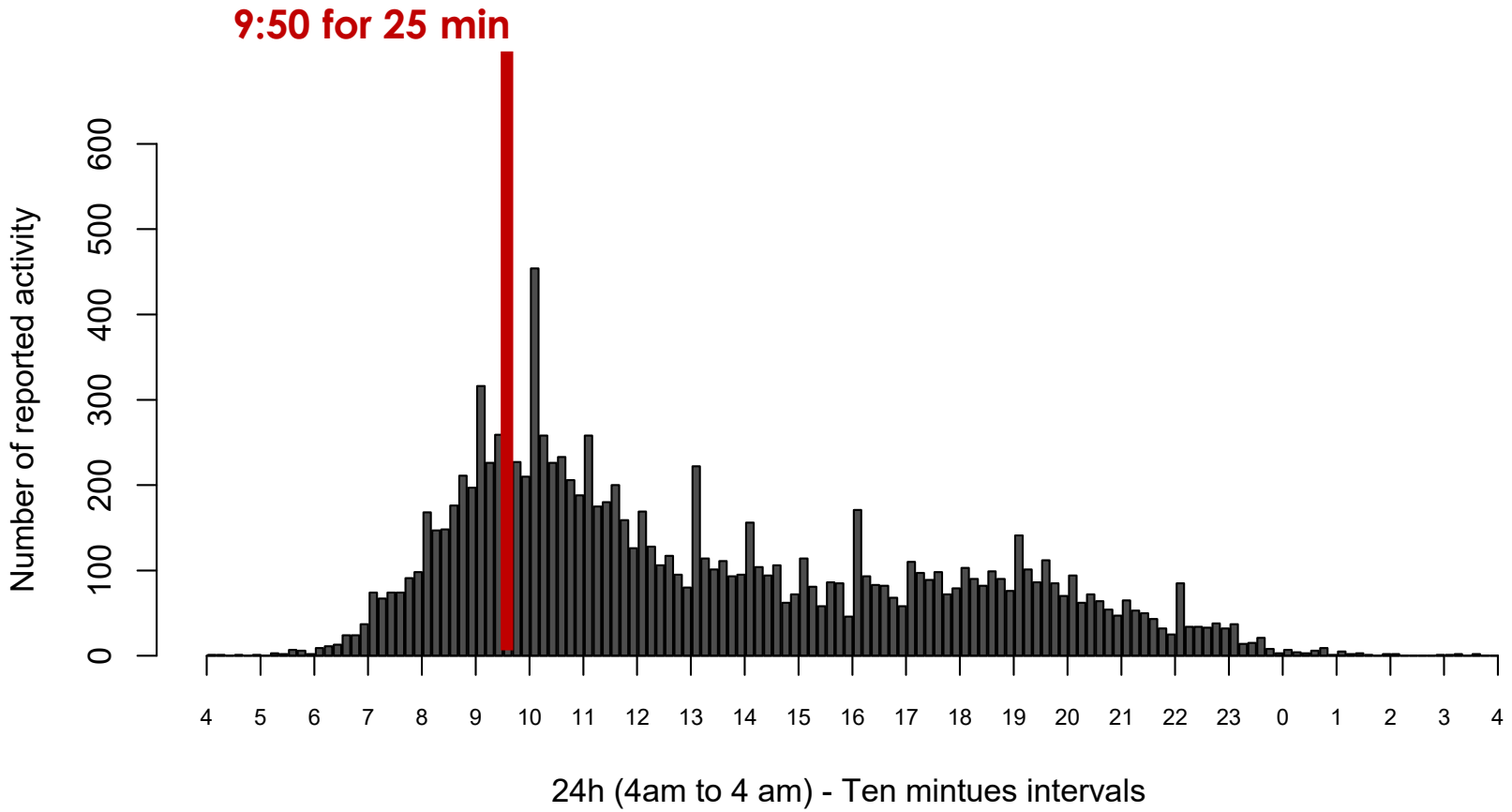
# Behaviour: cooking

- UK Time Use Survey to establish frequency & duration of behaviour



# Behaviour: cleaning

- UK Time Use Survey to establish frequency & duration of behaviour



# Behaviour: typical schedule for a day



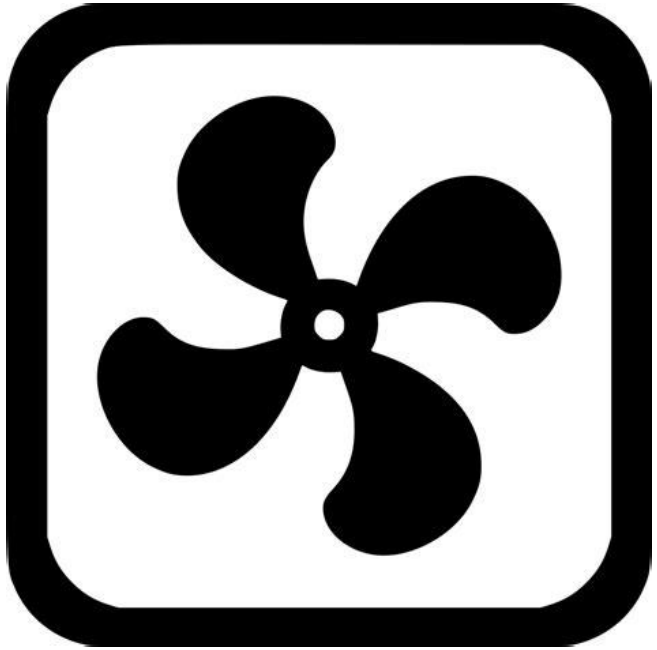
| Activity | Time | Duration (mins) |
|---|---|---|
| **Cooking Breakfast – Toast & Tea** | 08:00 – 08:16 | 16 |
| **Leave the room** | 08:16 – 09:10 | |
| **Washing up** | 09:10 – 09:25 | 15 |
| **Leave the room** | 09:25 – 09:50 | |
| **Cleaning the dwelling** | 09:50 – 10:15 | 25 |
| **Leave the room** | 10:15 – 12:30 | |
| **Cooking Pasta – low emission** | 12:30 – 12:48 | 18 |
| **Leave the room** | 12:48 – 13:30 | |
| **Washing up** | 13:30 – 13:46 | 16 |
| **Leave the room** | 13:46 – 17:30 | |
| **Cooking Stir fry - High emission** | 17:30 – 17:53 | 23 |
| **Leave the room** | 17:53 – 18:40 | |
| **Washing up** | 18:40 – 18:57 | 17 |

# Question:

What would be the particulate emission from these two dishes under different ventilation scenarios?

# Mitigation strategies

- Reduce behaviours – cooking, cleaning, solid-fuel fires, use of candles, smoking, etc.
- Choose low emission materials
- **Increase ventilation**



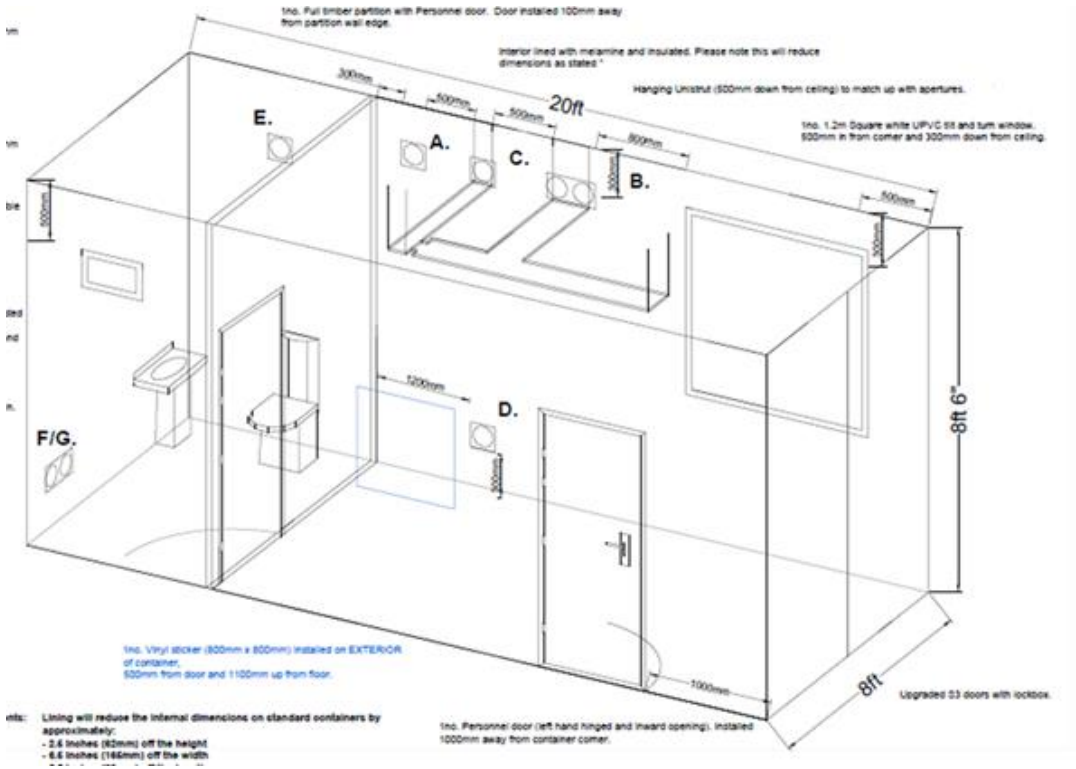
Reference: NICE (2020) Improving indoor air quality

# Tests

4 tests:

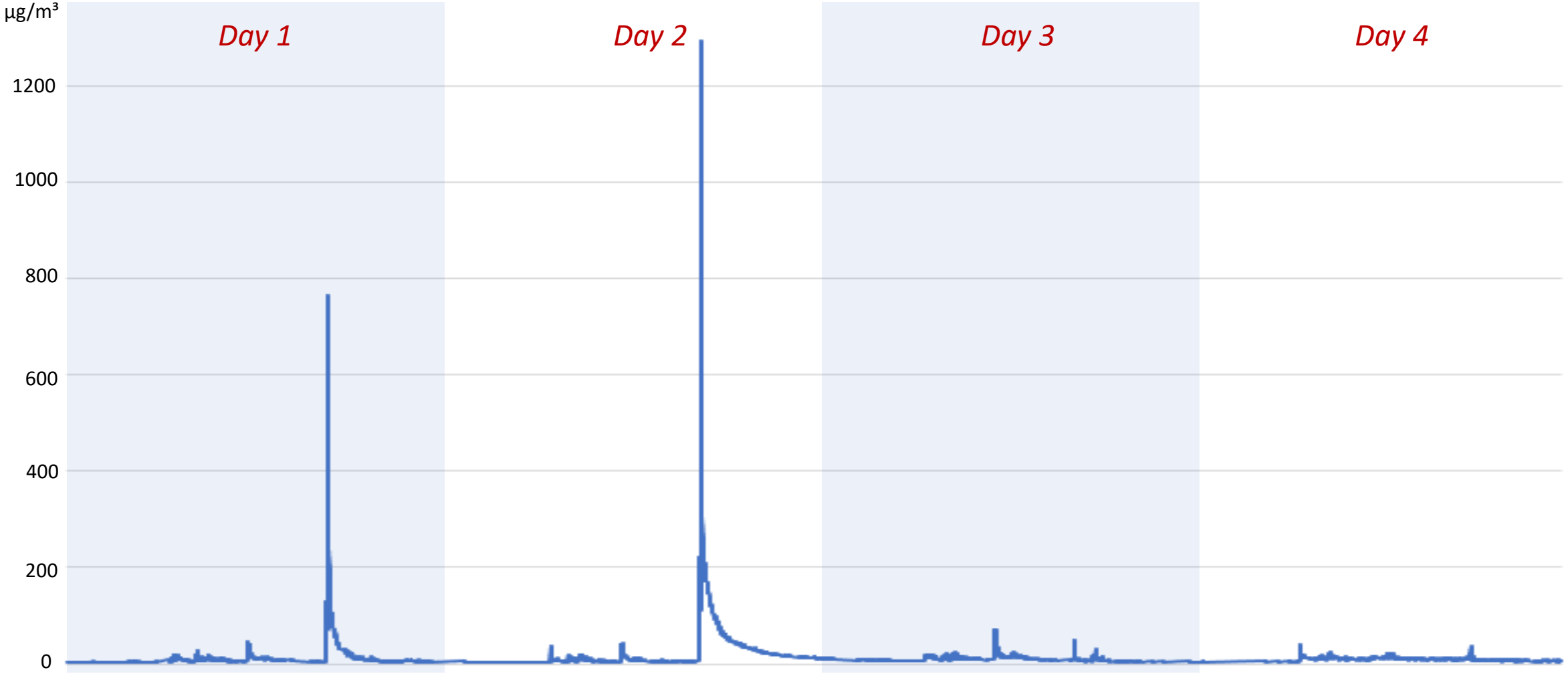
- two days *low* ventilation (Tue 6th & Wed 7th July 2021)
- two days *high* ventilation (Thu 8th & Fri 9th July 2021)

Measures: T, RH, $V_a$, $CO_2$, $NO_x$, $PM_1$, $PM_{2.5}$, $PM_{10}$, $O_3$, TVOC, $CH_4$, irradiance, bioaerosol




Reference: University of Chester https://www1.chester.ac.uk/news/university-project-analyse-air-quality-home?list=6800&linkedin

# Early Results – PM10



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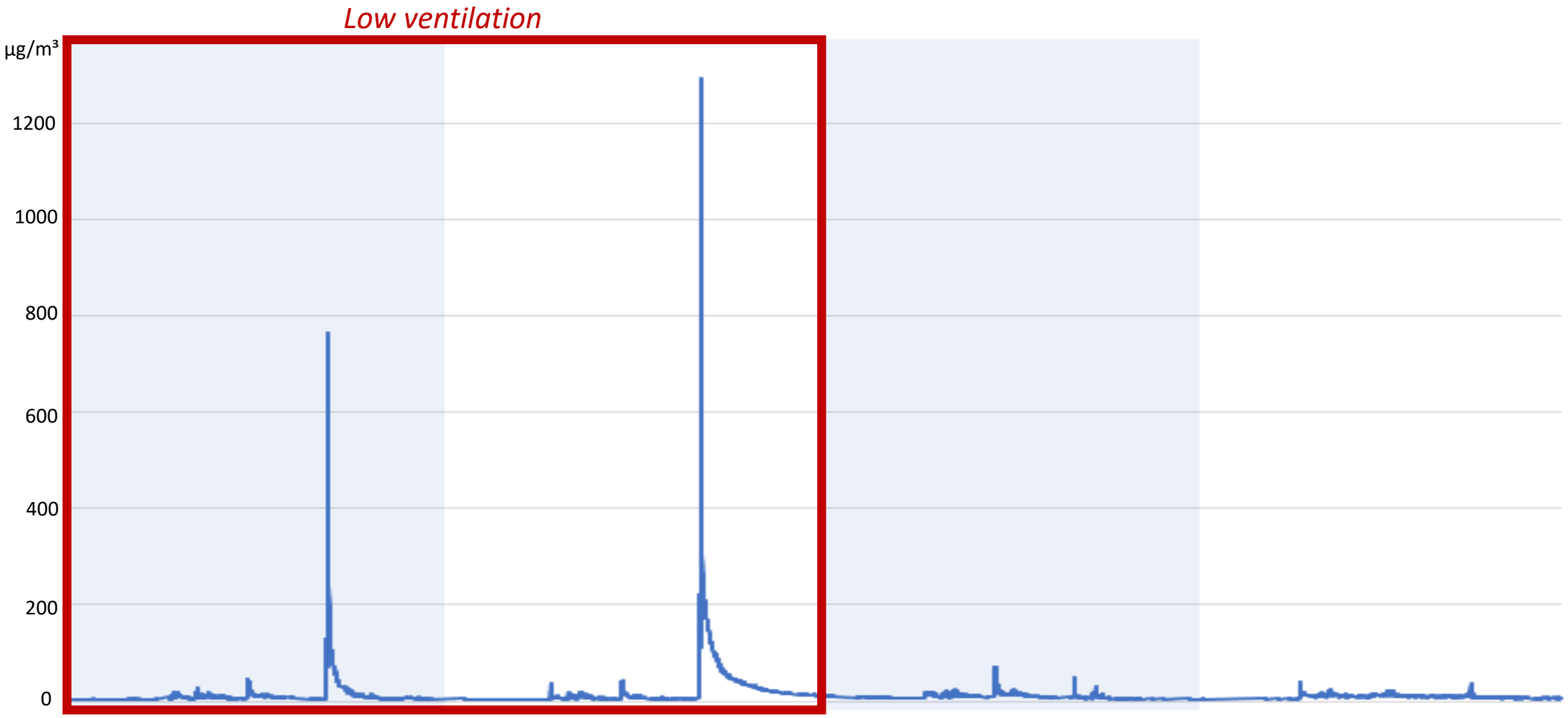

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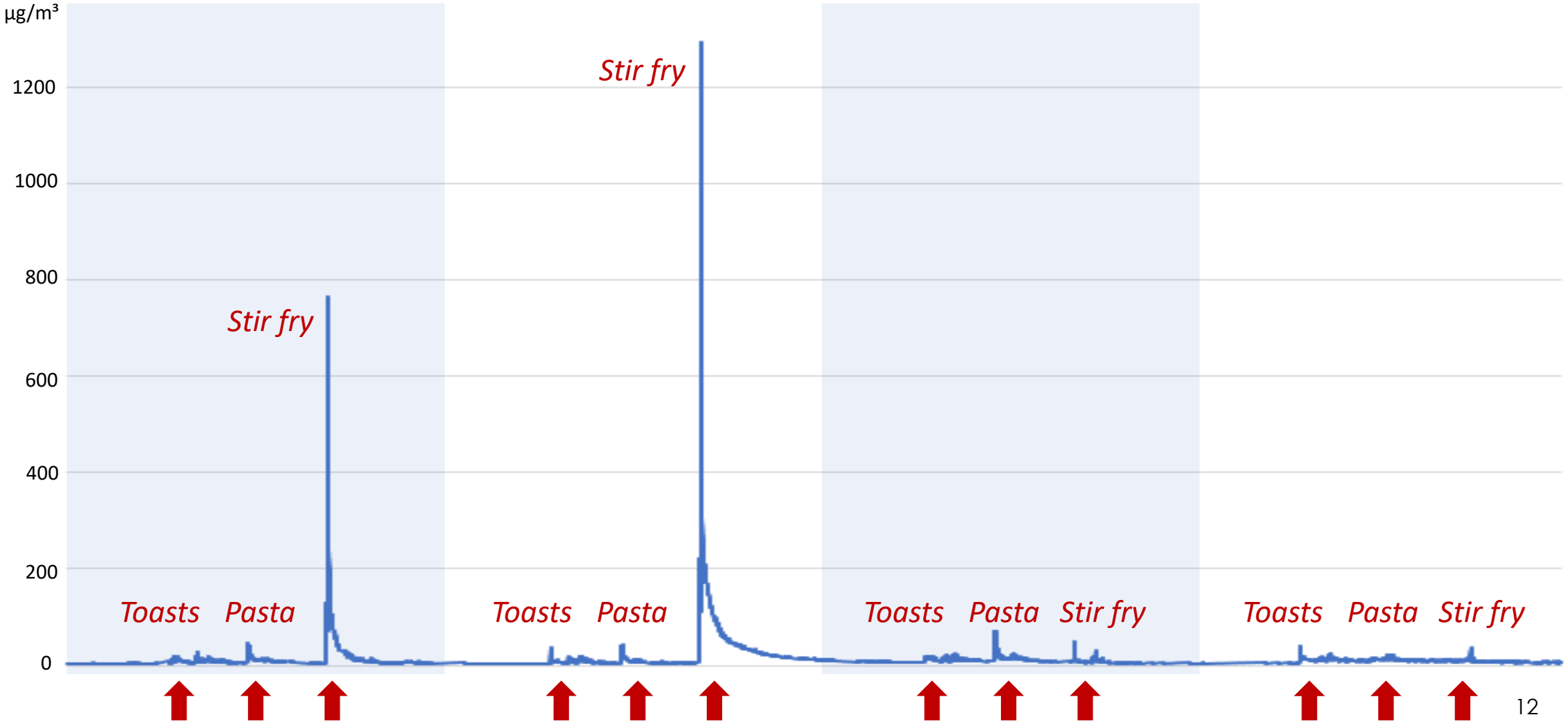

# Conclusions

Exposure is linked to

- Behaviour: type, duration, frequency

  stir fry cooking (344 µg/m³/20min) = 19.2 * pasta cooking (18 µg/m³/20min)

- Ventilation practices

  low ventilation (daily mean 20.4 µg/m³) = 2.6 * high ventilation (daily mean 7.7 µg/m³)

WHO 09/2021 15 µg/m$^3$ annual mean & 45 µg/m$^3$ 24-hour mean

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# EVOLVING CITIES

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