

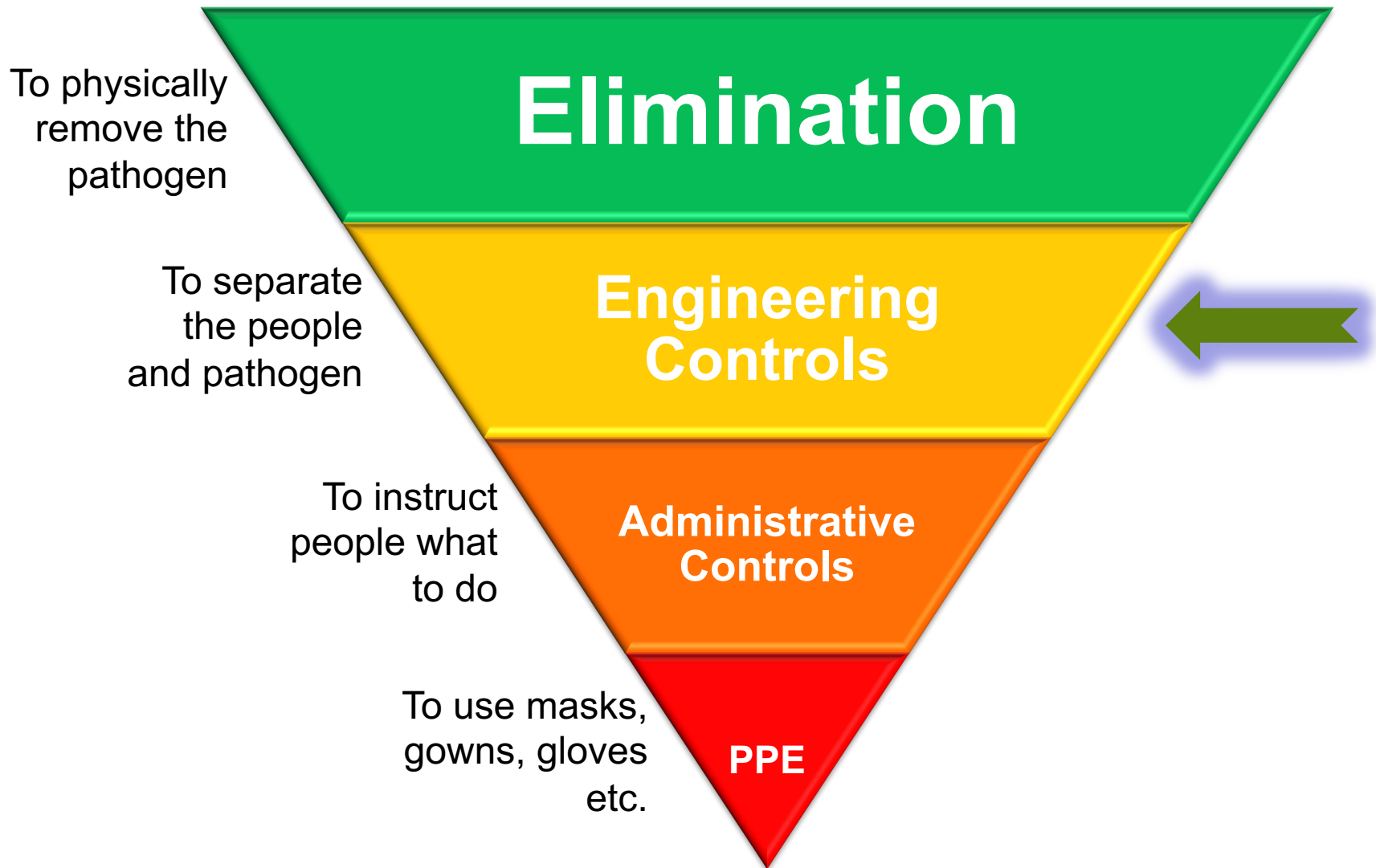
ASHRAE Webinar for Emerging Economies:
Managing COVID-19 and HVAC in Buildings for Emerging Economies
18 June 2020

HVAC system operation in residential buildings during a pandemic

Professor Chandra Sekhar, PhD
Fellow ASHRAE, ISIAQ
Department of Building,
School of Design and Environment
National University of Singapore, Singapore

Infection control pyramid adapted from US Centers for Disease Control (CDC)

CDC. HIERARCHY OF CONTROLS. Centers for Disease Control and Prevention; 2015



**VENTILATION
(Outdoor Air)**

Quality

Quantity (L/s)

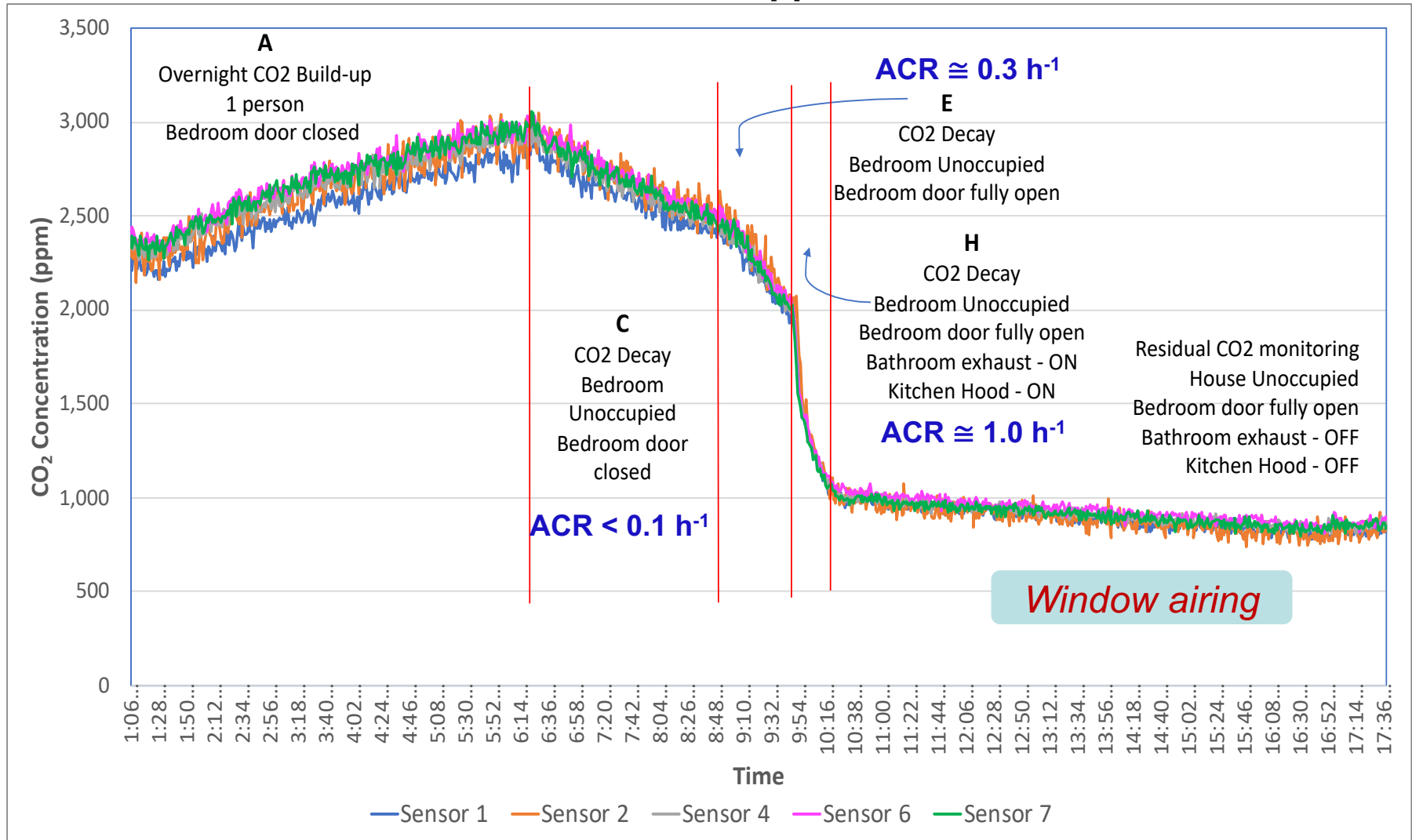
**Room air
distribution
(Ventilation
effectiveness)**

**Dilution of
indoor
contaminants**

Temperate Climate – Heating Season – Natural Ventilation

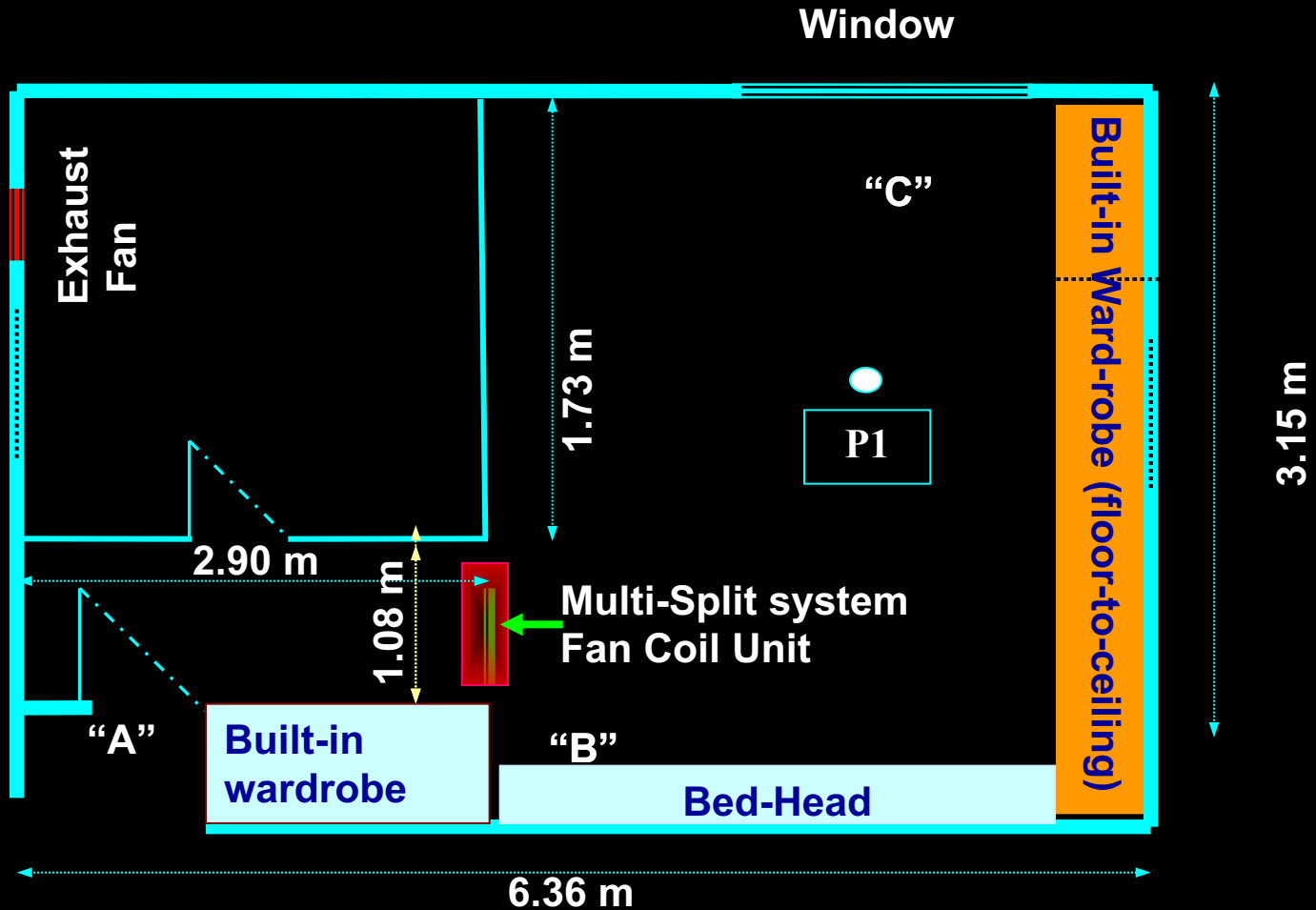
Semi-detached House with two levels – Trickle vents on windows and doors

- Bedrooms on upper level



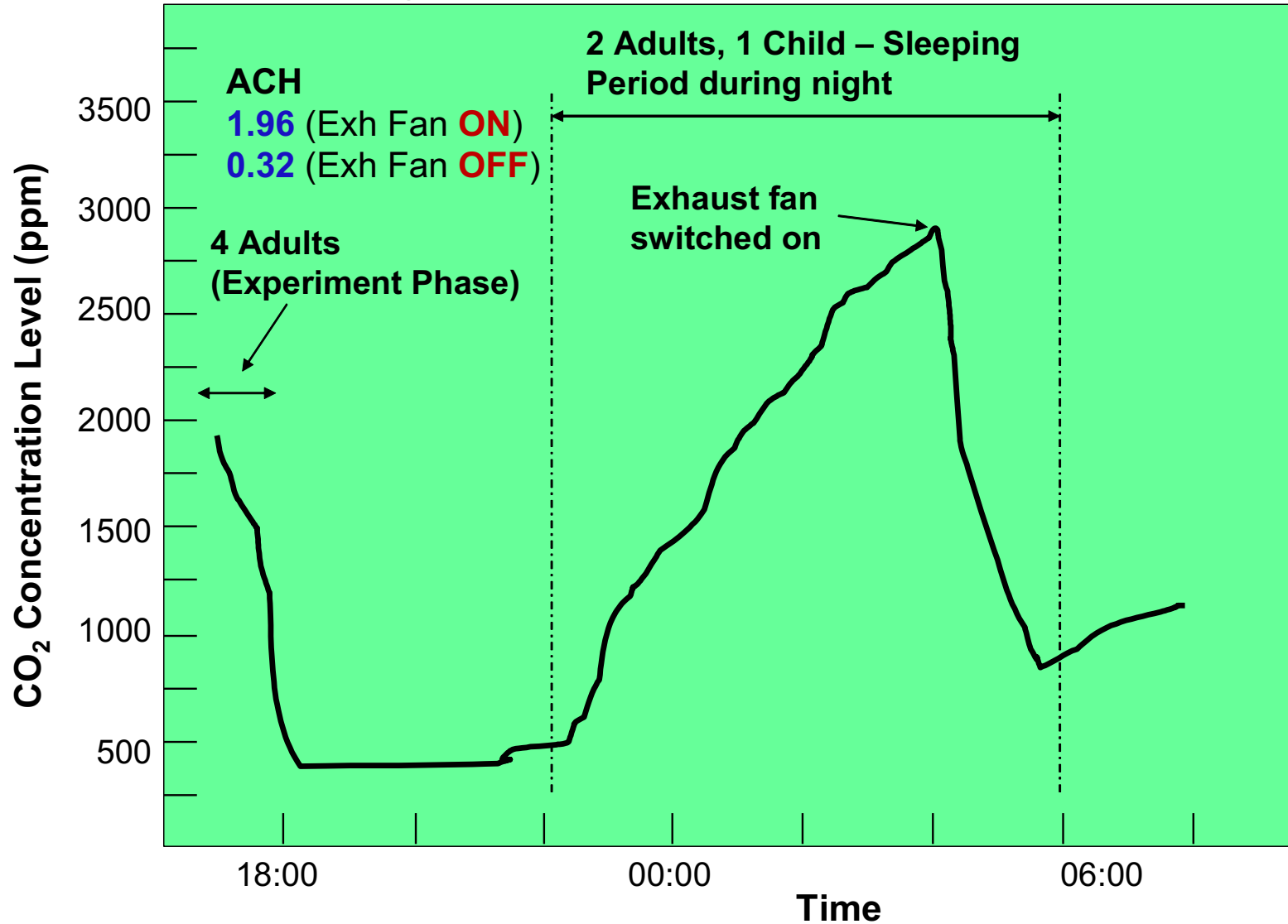
Bedroom CO₂ measurements

Tropical Climate – Split-System AC unit High-Rise Residential Apartment

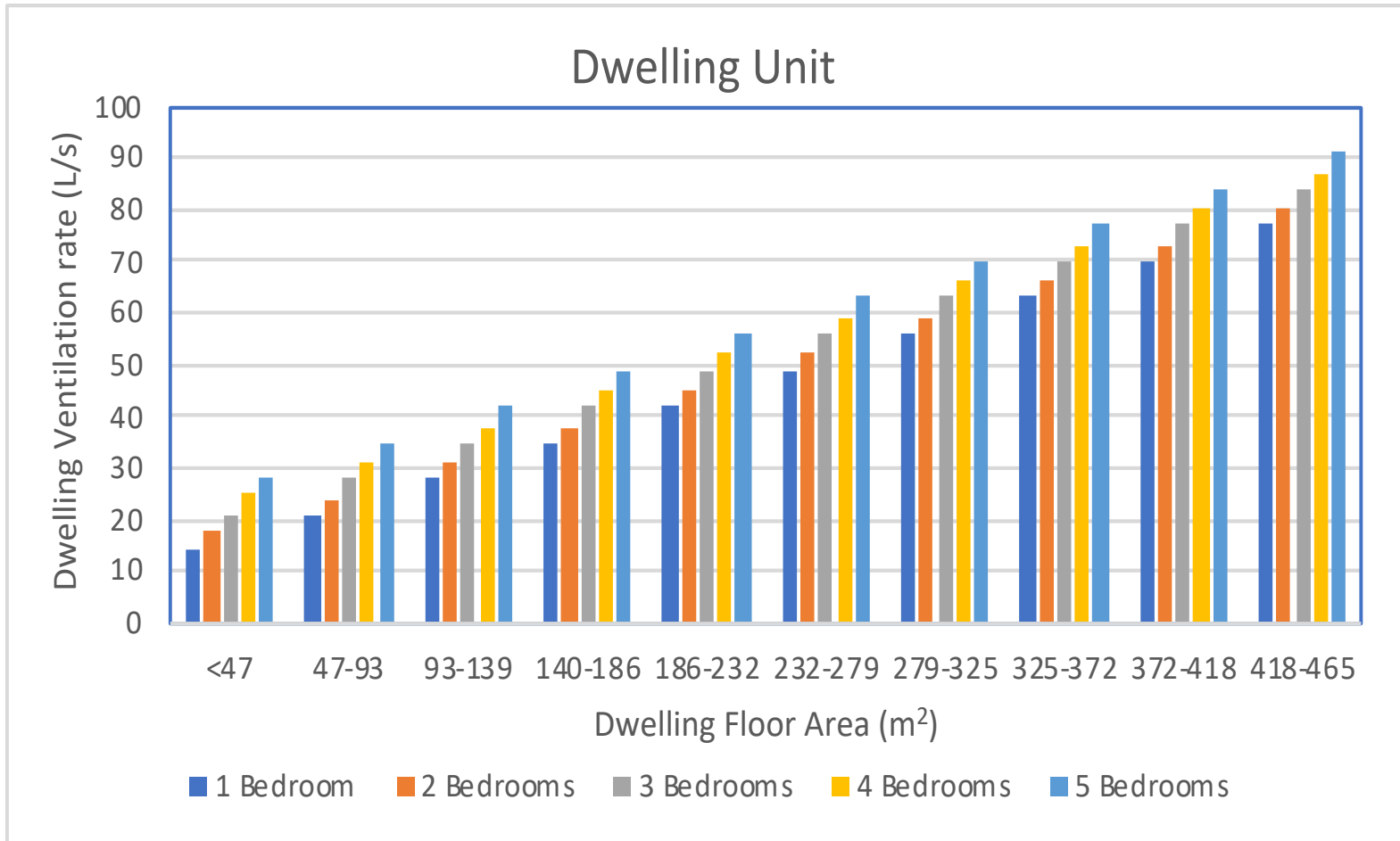


Master Bed-room in a condominium apartment (8th Storey)

Tropical Climate – Split-System AC unit High-Rise Residential Apartment

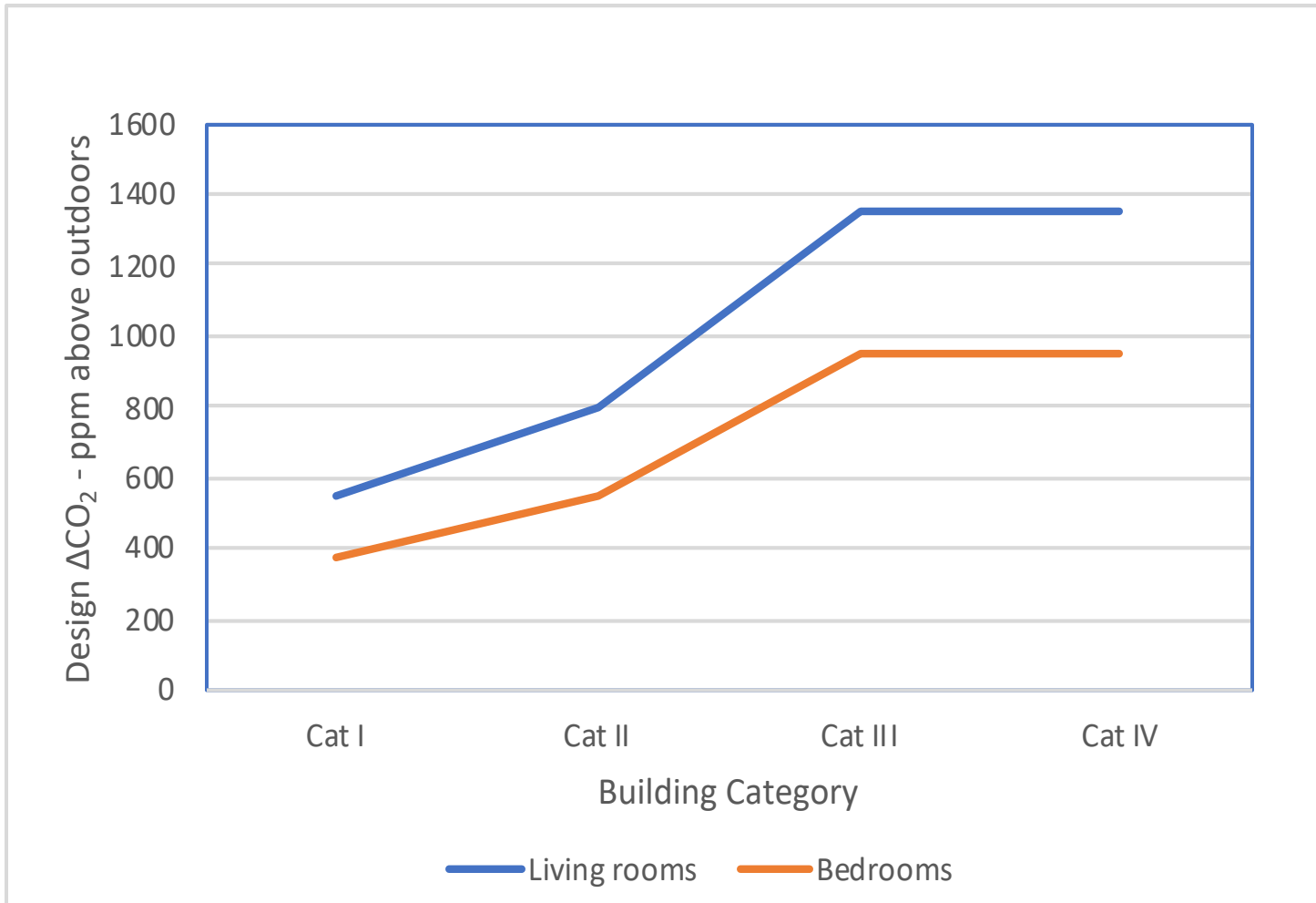


CO₂ concentration during measurement and night-time sleeping periods

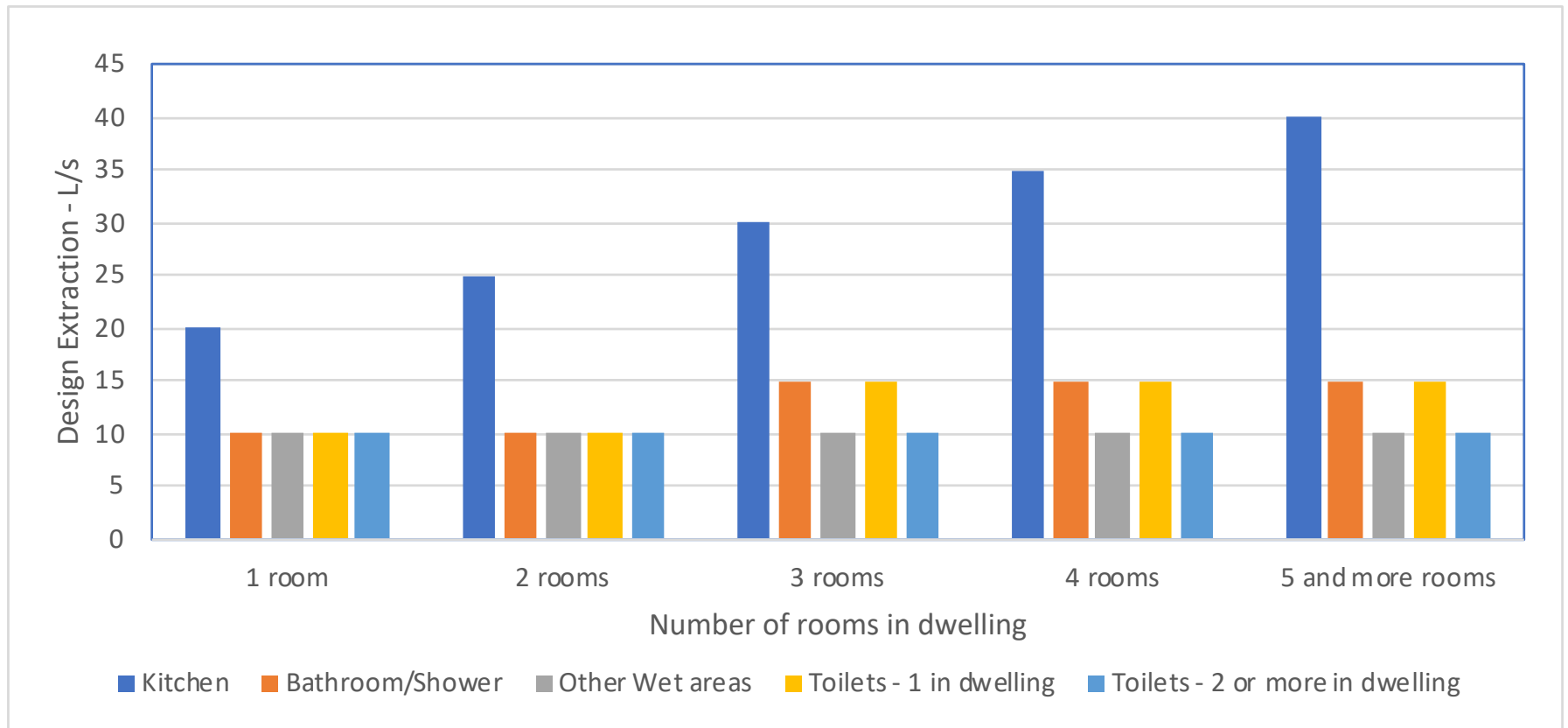


Ventilation requirements for whole dwellings – ANSI/ASHRAE Standard 62.2 (2019)

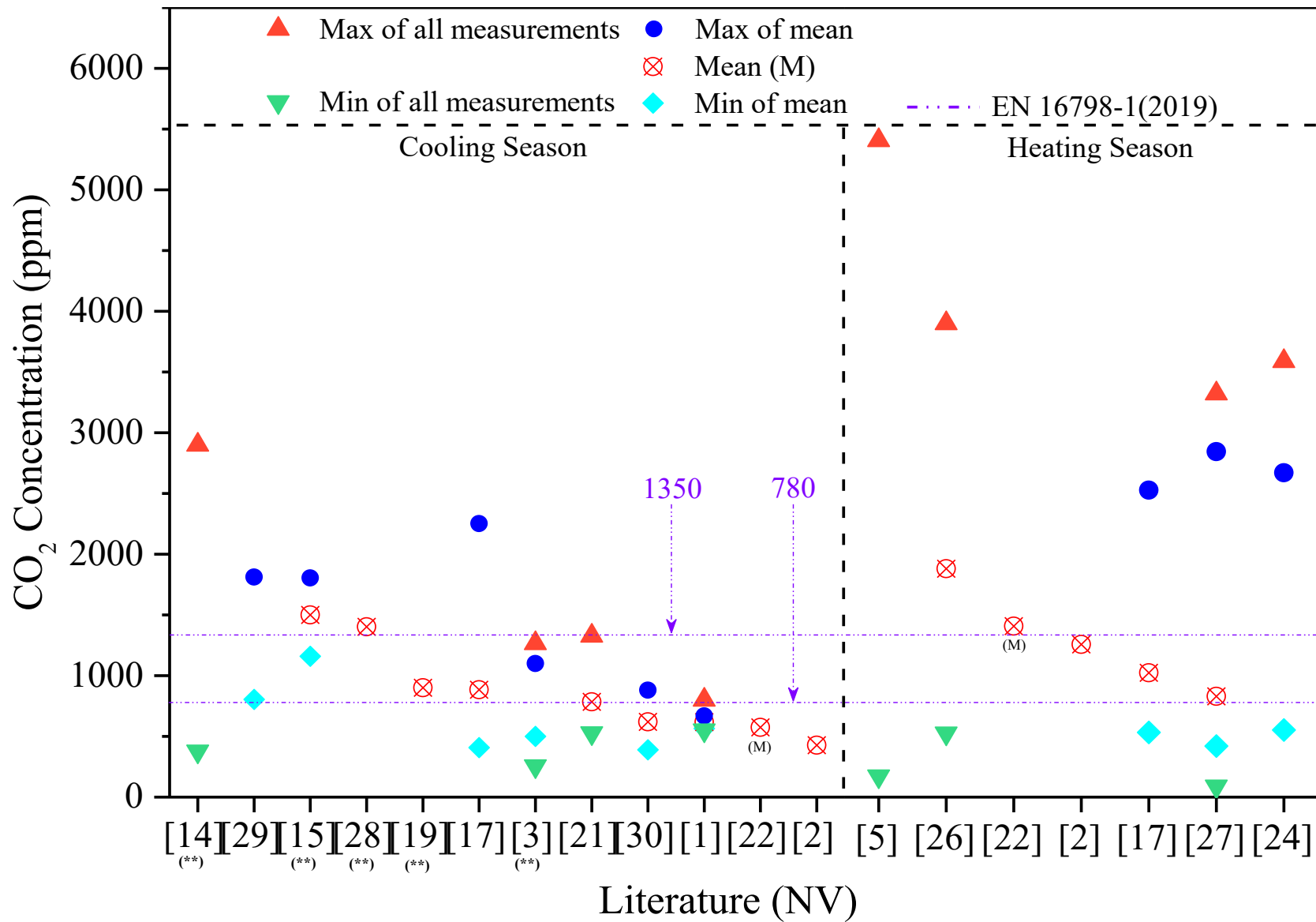
PAPER 3: S.C.Sekhar, Mizuho Akimoto, Xiaojun Fan, Mariya Bivolarova, Chenxi Liao, Li Lan and Pawel Wargocki 2020. Bedroom Ventilation and Sleep – A Review (article under preparation)



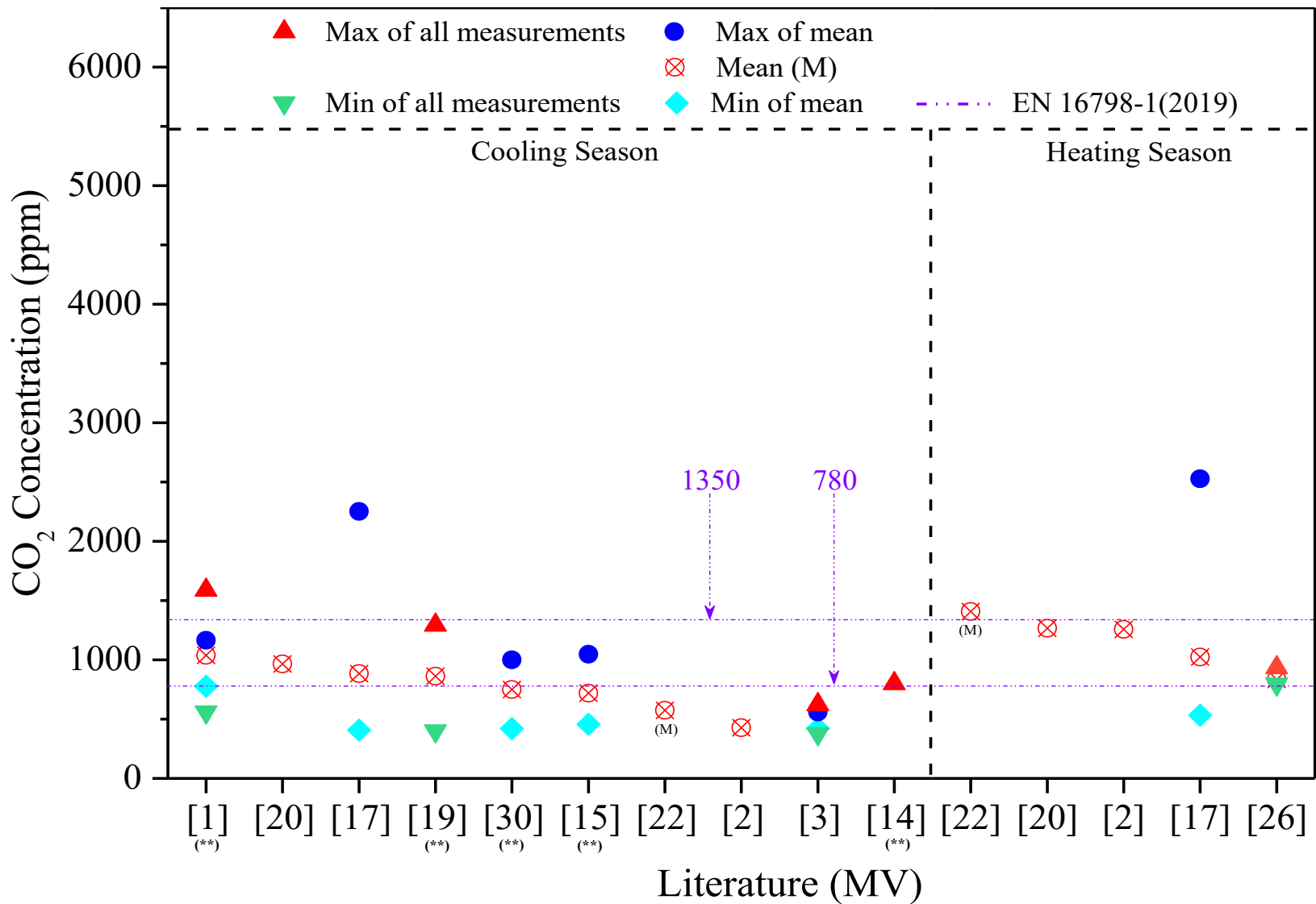
Design CO₂ levels in living rooms and bedrooms - EN 16798-1:2019



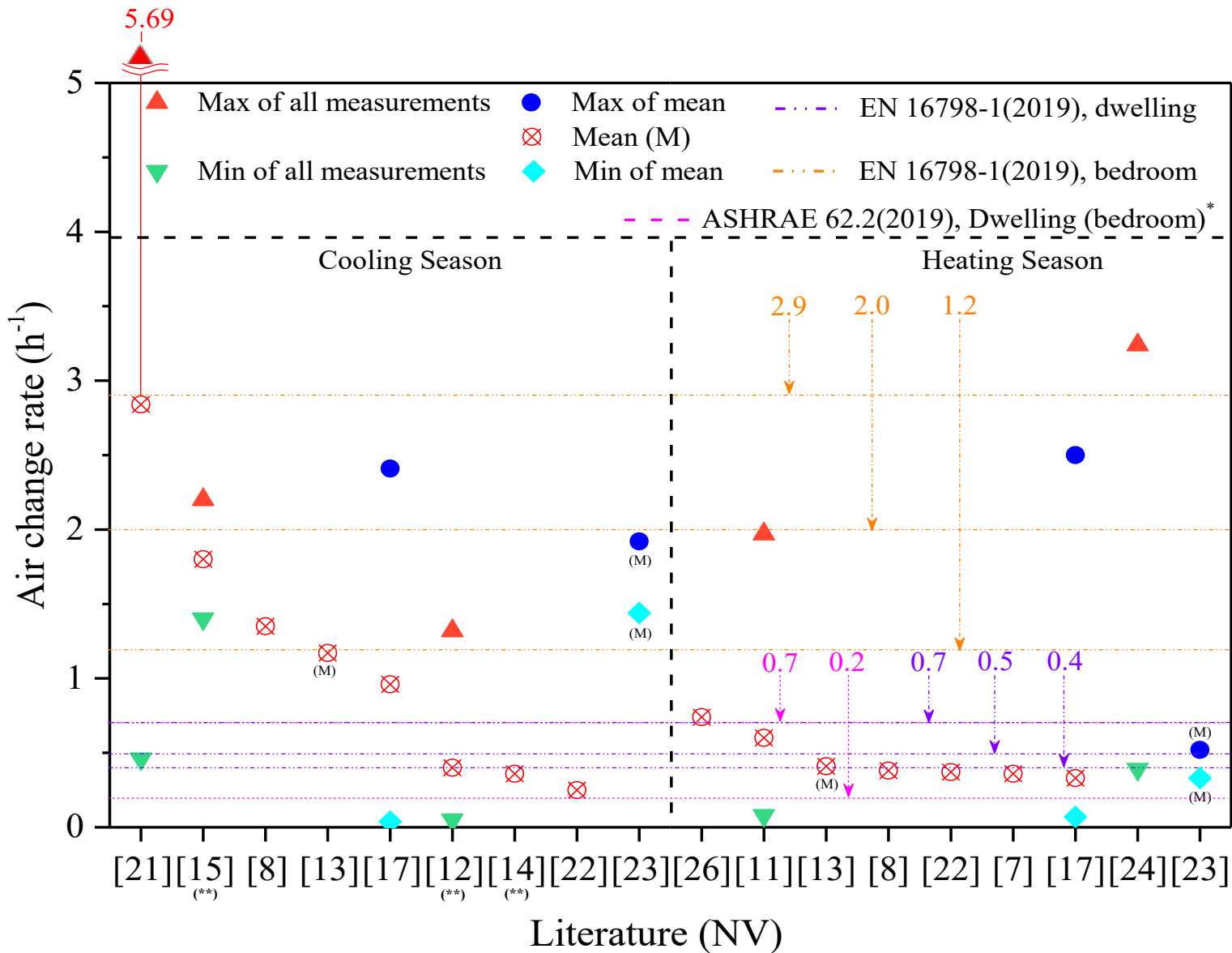
Design extraction air flow rates by room and building type - EN 16798-1:2019



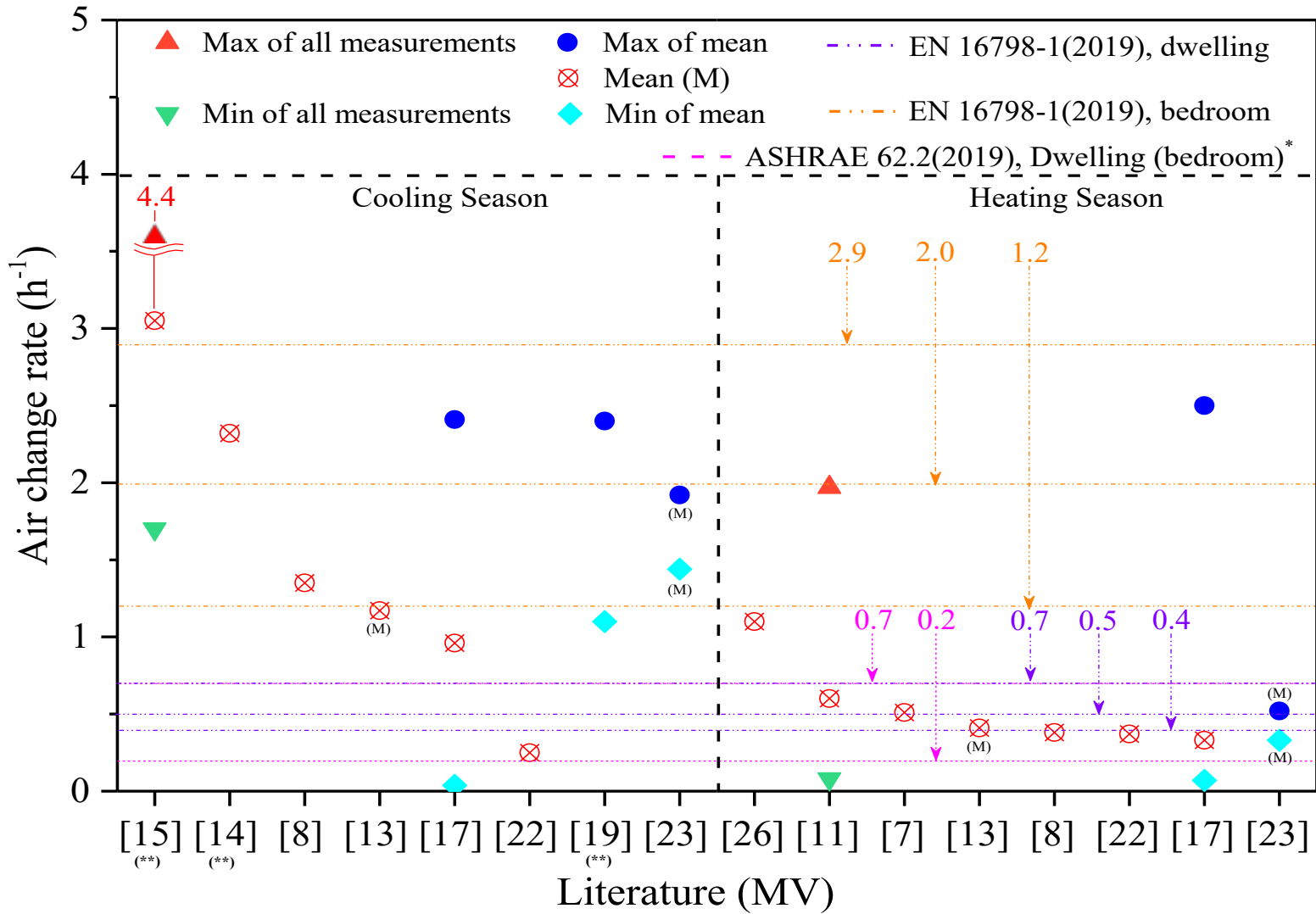
Reported CO₂ values in the literature for NV bedrooms across heating and cooling seasons



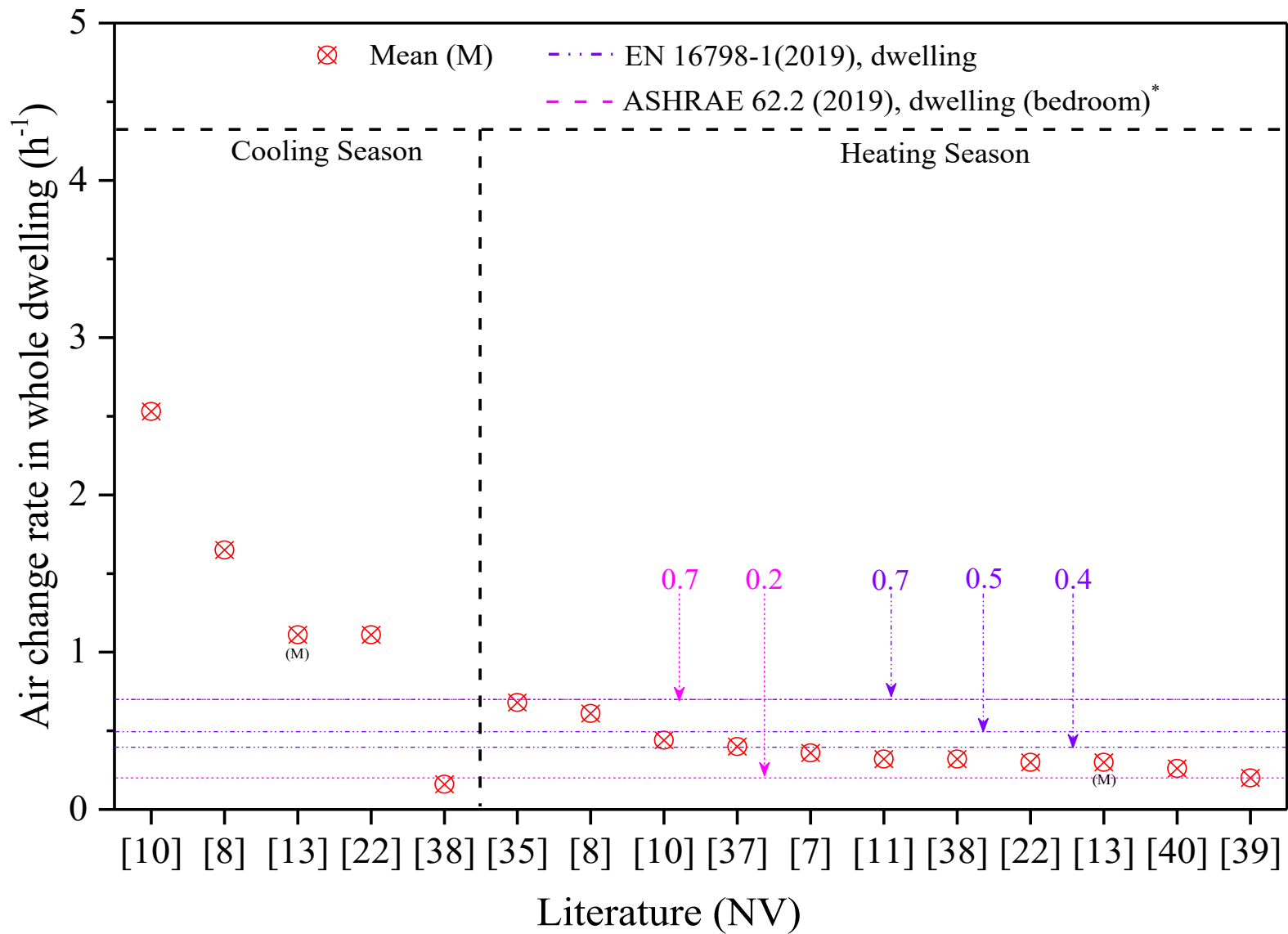
Reported CO₂ values in the literature for MV bedrooms across heating and cooling seasons



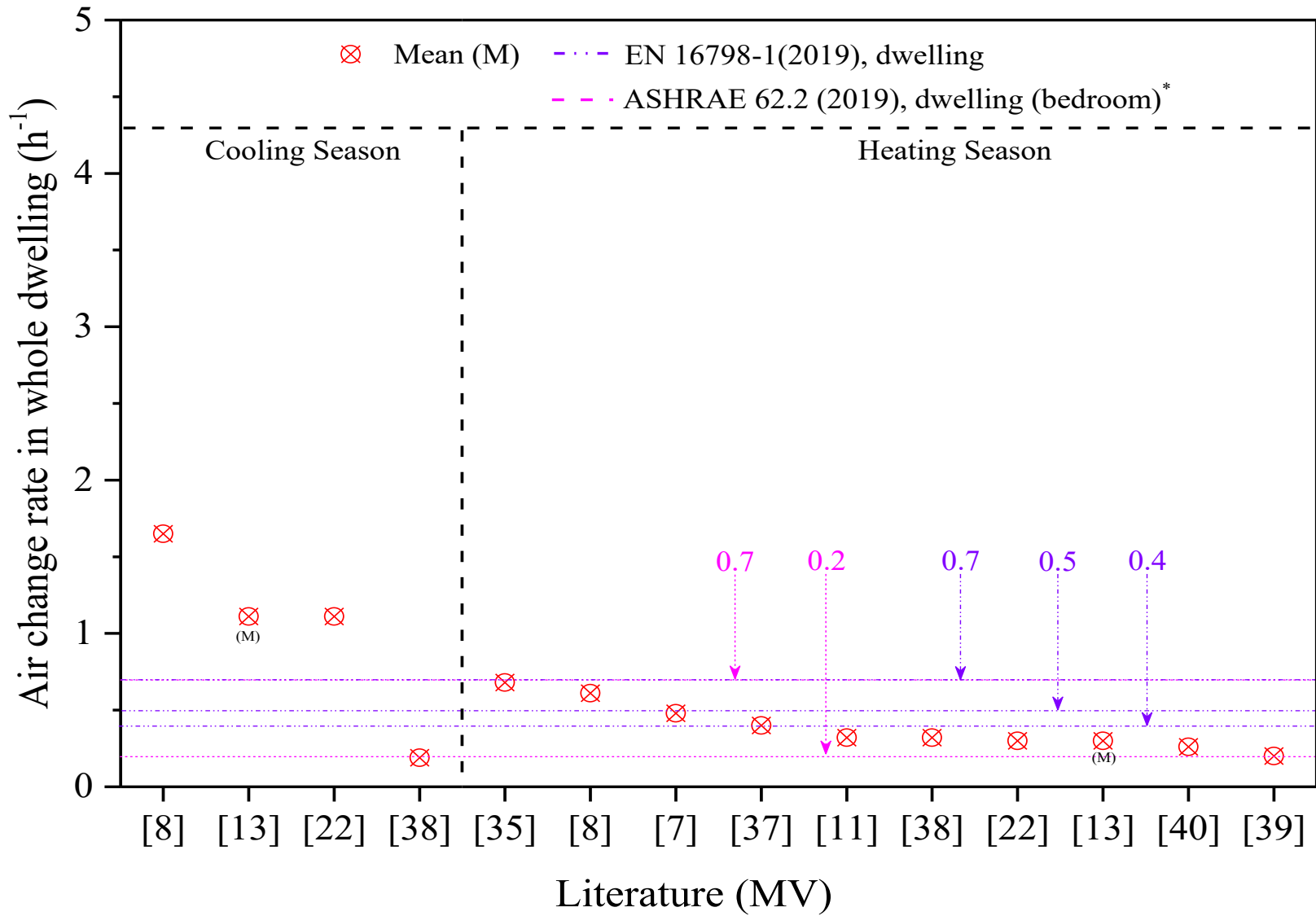
Reported ACH values in the literature for NV bedrooms across heating and cooling seasons



Reported ACH values in the literature for MV bedrooms across heating and cooling seasons



Reported ACH values in the literature for whole dwelling across heating and cooling seasons - NV



Reported ACH values in the literature for whole dwelling across heating and cooling seasons - MV

RESIDENTIAL IAQ GUIDE

<https://www.ashrae.org/technical-resources/residentialnew#general>

RESIDENCES FAQ

<https://www.ashrae.org/technical-resources/residences-faq>

Concluding Remarks

Principles of ventilation

Ventilation in Residential Buildings – Field Data –
Temperate and Tropical climate examples

Ventilation in Residential Buildings
– A Review of literature

COVID 19 Guidance – ASHRAE – RESIDENTIAL IAQ GUIDE

COVID 19 Guidance – ASHRAE – RESIDENCES FAQ

Thank You for your Attention

Q & A



Professor Chandra Sekhar
bdgscs@nus.edu.sg