

**Table 4. HVAC systems and combustion-derived air pollution episodes**

Reference	Episode	HVAC	Building Type	Outcome
Holder et al. 2025 <sup>38</sup>	Wildfire	HVAC MERV 8 filter buildings (n = 18; 78% of the buildings), MERV 11 (n = 1), MERV 13 (n = 1), MERV 14 (n = 1), No HVAC system (n = 2)	Church (n = 2), university (n = 2), office (n = 6), hotel (n = 1), fire station (n = 1), museum (n = 2), fitness centre (n = 7), childcare centre (n = 4), community centre (n = 3)	<ul style="list-style-type: none"> <li>- PM<sub>2.5</sub> median (range) I/O for building occupied was 0.59 (0.28 to 0.76) and for building unoccupied was 0.60 (0.27, 0.88) during a heavy wildfire period in 2020</li> <li>- PM<sub>2.5</sub> median I/O ratios increased when HVAC filter bypass was higher, or if the HVAC system was in poor condition, and decreased room pressure was positive</li> </ul>
Montrose et al. 2022 <sup>33</sup>	Wildfire	HVAC with MERV 13 filters	Nursing facility (n = 4) 15,000 to 30,000 ft <sup>2</sup>	<ul style="list-style-type: none"> <li>- PM<sub>2.5</sub> I/O ratio increased (0.27 to 0.56) from non-wildfire to wildfire days</li> <li>- PM<sub>2.5</sub> F<sub>inf</sub> increased (0.29 to 0.59) from non-wildfire to wildfire days</li> </ul>
Dev et al. 2021 <sup>34</sup>	Wildfire	HVAC systems 1) University building: HVAC MERV 8 prefilter and MERV 11 final filter 2) House A: Ventilation off 3) House B: HVAC, MERV 11,	1 public building and 2 residential detached houses	<ul style="list-style-type: none"> <li>- PM<sub>2.5</sub> I/O ratios during wildfire: University building: 0.37, House A: 0.14, House B: 0.44</li> <li>- PM<sub>0.3-10</sub> number and mass concentrations during wildfire: University building: significantly elevated, House B: significantly elevated</li> </ul>
Mendoza et al. 2021 <sup>54</sup>	Wildfire	Two general AHUs, five dedicated exhaust fans for the BSL 3 labs, perchloric acid and radioisotope exhausts	Laboratory and office building (82,000 square feet)	<ul style="list-style-type: none"> <li>- Indoor PM<sub>2.5</sub> concentration was 78% of outdoor during wildfire, and 29% during non-wildfire</li> </ul>
Kaduwela et al. 2019 <sup>24</sup>	Wildfire	HVAC in school equipped with MERV 8 filters	High school	<ul style="list-style-type: none"> <li>- PM &gt; 0.3µm number concentrations were 10–15 times higher indoors comparing wildfire with prior period</li> </ul>
Tham et al. 2021 <sup>45</sup>	Haze	FFU with 350 mm diameter axial fan 50 Hz, 1420 RPM, 2559 m <sup>3</sup> /h, with a MERV13 filter	School building, two classrooms (313 m <sup>3</sup> ), same location one floor apart	<ul style="list-style-type: none"> <li>- PM I/O ratios reduced (0.47–0.50 to 0.05–0.07) comparing FFU room with control room</li> <li>- F<sub>inf</sub> for all PM sizes were reduced (0.2–0.3 to 0.06–0.11) comparing FFU with control</li> <li>- Using a FFU inside during haze events reduced PM<sub>10</sub>, PM<sub>2.5</sub>, and PM<sub>1</sub> by 75%–85% (56, 48, and 30 µg/m<sup>3</sup>)</li> </ul>

Reference	Episode	HVAC	Building Type	Outcome
<b>Cao et al. 2016<sup>46</sup></b>	Haze	Filters attached to fan coil unit, (1) F25: MERV 7, (2) F65: MERV 11, (3) F85: MERV 13, (4) F95: MERV 14	Five neighboring classrooms (60 m <sup>2</sup> ), Nanyang Technological University	<ul style="list-style-type: none"> <li>- PM I/O ratios reduced from 0.2–0.62 to 0.06–0.24 comparing MERV 13 or 14 filters with control</li> <li>- MERV 13 filter reduced indoor PM<sub>0.3-2.5</sub> by 48% (68.5 µg/m<sup>3</sup>) on heavy haze days (outdoor PM<sub>0.3-2.5</sub> 279 µg/m<sup>3</sup>)</li> </ul>
<b>Chen et al. 2016<sup>47</sup></b>	Haze	Air-conditioning and mechanical ventilation system with MERV 7 filter	Staff office (300 m <sup>2</sup> ), Nanyang Technological University	<ul style="list-style-type: none"> <li>- PM<sub>0.3</sub> particle concentration I/O ratio was reduced from 0.64 to 0.059 comparing AC on vs. off</li> <li>- Removal efficiencies for particles of 0.37–3.74 µm are significantly higher (4%–25%) in the AC on mode</li> </ul>

Abbreviations: **AC**: air-conditioning, **BC**: black carbon, **FFU**: fan filter unit, **NR**: not reported, **PM<sub>x-y</sub>**: particulate matter x-y µm in diameter, **RWC**: residential wood combustion.