

## Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

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## **eMethods. Supplementary Methods**

### **Subject Characteristics between Filtration Conditions**

The experimental period was from Dec. 1, 2014 to Jan. 30, 2015. From Dec. 1 - Dec. 5 and then from Jan. 14 - Jan. 30, participants had identical central air handling units (AHUs) with a mini-bag filter (F8, MERV 12), followed by an electrostatic precipitator (ESP), and then a high-efficiency particulate air (HEPA) filter. This three-device configuration was installed as part of the central AHUs that separately served each floor of the office building in which the subjects worked, and also as part of one large central AHU for each dorm building in which the subjects lived.

From Dec. 6 - Jan. 13, both the office and dormitory AHUs were modified in one of two ways: (1) the ESP was turned off and the HEPA filter removed while the F8 filter remained in place, or (2) the ESP was turned off while the F8 filter and HEPA filter remained unchanged. Of the original 89 subjects, 3 dropped out after the first biomarker measurement period (Dec. 2 - Dec. 5). Of the remaining 86 subjects, 34 experienced AHU Condition (1) and the remaining 52 experienced AHU Condition (2). The demographic characteristics of the subjects experiencing these AHU condition changes were compared by t-test for continuous variables and chi-squared test for categorical variables, and the p-values of these tests are presented in eTable 1. The only major demographic difference other than the difference in total number was in the proportion of ex-smokers, and this difference approaches statistical significance. However, the total pack-year characteristics do not differ significantly.

Subjects who experienced Condition (1) (i.e., ESP & HEPA) worked on Floor 4, and subjects who experienced Condition (2) (i.e., ESP only) worked on Floor 3 of the same office building. These floors were sealed off from each other and had separate AHUs, and so there was little mixing of the indoor air downstream of the office filtration units. In terms of the dormitories, subjects experiencing Condition (2) stayed in the same dormitories for the entire study, which included dorm buildings #1-6. Subjects experiencing Condition (1) moved from their original dormitories, which included dorm buildings #1-4, on Dec. 6, 2014 into an adjacent building on the same Broad Town campus, dorm building #7, for the remainder of the study. Dorm building #7 had its HEPA filter and ESP removed during the intervention period and reinstalled when the intervention period ended on Jan. 14, 2015 (i.e., from Jan. 14-30 all subjects from both groups experienced the same filtration conditions in both their office and dormitory setting; this was also the case from Dec. 1-5).

### **Additional Biomarker Measurement Methods**

Breath samples were collected using a device that creates a seal around each subject's mouth and uses a one-way valve with activated carbon for scrubbing ambient NO. The subjects breathed in through the NO-scrubbing inlet, and then exhaled through a flow meter into a 4L aluminum bag at a steady flow rate of 6 to 9 L/min. The breath samples were analyzed for FeNO within hours of collection using a chemiluminescence analyzer (Model 42i, Thermo Scientific, Waltham, USA). EBC from 15 minutes of tidal breathing was collected using a condensation device (ECoScreen, Jaeger, Germany) and stored at -30 °C. EBC MDA was analyzed through thiobarbituric acid-derivatization and HPLC-fluorescence detection<sup>1</sup>. EBCNN was analyzed with HPLC-UV detection<sup>2</sup>.

Spirometry was performed with a Spirolab III (Medical International Research, Rome, Italy), in which the best measures out of three valid expiratory efforts were selected as representative. PWA measurements were performed with a VICORDER (SMT Medical, Würzburg, Germany), including the measurement of SBP, DBP, and AI with a brachial pressure cuff, as well as PWV with carotid and femoral pressure cuffs. The average of three tests was used for evaluating each of the PWA measures.

### **Indoor Air Monitoring Schedule**

Indoor PM<sub>2.5</sub> mass concentration was continuously measured in the two involved office floors during the day (09:00-18:00) and in two dormitory rooms (out of 35 rooms in 7 buildings total) at night (20:00-08:00) using field-calibrated nephelometers (Sidepak AM510, TSI Inc., Shoreview, USA). Daytime indoor O<sub>3</sub> was continuously measured using a single UV absorption monitor (Model 205, 2B Tech., Boulder, USA) first placed in one of the offices from 09:00-11:00, then the other office from 11:00-16:00, and finally 16:00-18:00 in the original office, alternating which office was measured first. During the night (20:00-22:00), indoor O<sub>3</sub> was monitored for two one-hour periods in one selected dormitory room each day.

### **Calculations for 24-Hour Exposure Measures**

This section elaborates on the methods used to calculate the 24-hour and 2-week exposure concentrations. The time-activity questionnaires consisted of three sections: (1) personal conditions, (2) activities over the past 7 days, and (3) activities over the past 24 hours. The first section simply asks whether the subject has a respiratory infection or is menstruating and how many hours ago a subject last ate food (covariates labeled RIS, MS, and LA,

respectively, in eTable 5), as these could influence the biomarkers evaluated in the study. Subjects were separately asked about any other illnesses or sudden medication changes during each visit. The second section only requested total times in hours that subjects spent in their dormitories, offices, and other places during the past 7 days, as well as specification of the other locations and how many hours were spent in each of those settings. The third section included the most detail, asking over the past 24 hours which specific times (down to the minute) did the subject spend in their dormitories, offices, outside at Broad Town, outside in other environments and where those locations were, inside in other environments and where those locations were, and hours spent in the same room as someone smoking as a measure of secondhand smoke exposure. The “secondhand smoke” times would later be totaled over the 24 hours prior to biomarker sampling ( $T_{SHS_{24h}}$ ) to use as a covariate in the mixed models associating biomarker outcomes with exposure predictors. The questionnaires were given to subjects to fill out during their second session of the biomarker sampling visit when pulse wave analysis, spirometry, and breath and EBC samples were collected, and so this was the start point from which time was counted backwards to get 24-hour, etc. averages. As this could differ from the time of blood and urine sampling (the first session; always 8:00 AM) by up to 9 hours, we also tried separately calculating 24-hour exposures for each pollutant starting from the blood and urine sampling times for use in models with blood and urine sample-derived biomarker outcomes. However, these “blood and urine” exposure means were very highly correlated with the original exposure means ( $\rho = 0.93-0.99$ ), and so they were not used in the exposure-biomarker association mixed models.

These 24-hour specific time data were combined with measured and modeled indoor O<sub>3</sub> and PM<sub>2.5</sub> data for the offices and dorms as well as outdoor data for O<sub>3</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, and SO<sub>2</sub> to calculate a total exposure concentration for each pollutant for each hour. 3.8% of the hourly outdoor pollutant concentration data were missing, and we used linear interpolation to impute these missing values when possible. When measured PM<sub>2.5</sub> values were not available, the modeled indoor PM<sub>2.5</sub> concentrations were based on I/O ratios for dormitories and the main office levels under different AHU conditions. Dormitory PM<sub>2.5</sub> I/O ratios were separated by building and also separately evaluated for subjects who were current smokers, as these dormitories tended to include indoor PM<sub>2.5</sub> sources from the smoking habits of roommates or the subjects themselves, though subjects were asked to refrain from smoking and incense burning in their dorms. Also, no cooking occurred in the dorms, as they did not have kitchens and all meals were provided in nearby cafeterias. Office PM<sub>2.5</sub> I/O ratios were separately evaluated for office Floors 3 and 4. There were few indoor PM<sub>2.5</sub> sources in the offices, as workers were not permitted to cook, burn incense, or smoke there. See eTable 2 for mean location- and filtration-specific I/O ratios for PM<sub>2.5</sub> used to estimate missing indoor PM<sub>2.5</sub> concentration data.

When measured O<sub>3</sub> values were not available, the modeled indoor O<sub>3</sub> concentrations in ppb for either the offices or the dorms were calculated as shown in Equation 1:

$$C_{in}(t) = \begin{cases} 0.2 \cdot C_{out}(t) + 3, & \text{with ESP present} \\ 0.2 \cdot C_{out}(t), & \text{with ESP absent} \end{cases}$$

**Equation 1**

These equations use a value of 0.2 for the I/O ratio of O<sub>3</sub> in either the offices or dorms, and add 3 ppb of O<sub>3</sub> to the room air when the ESP is operating. Both the I/O ratio and the additional O<sub>3</sub> are based on measurements conducted in the offices and dorms. These measurements can be understood in the context of a mass balance model for indoor O<sub>3</sub> (Equation 2-3):

$$\frac{dC_{in}(t)}{dt} = \left(1 - \frac{\gamma_{filt}}{2}\right) \cdot \frac{\varepsilon}{V_{room}} \cdot R + (1 - \gamma_{filt}) \cdot \lambda_v C_{out}(t) - \lambda_v C_{in}(t) - k_d C_{in}(t) - k_h C_{in}(t)$$

**Equation 2**

where  $C_{in}(t)$  and  $C_{out}(t)$  are indoor and outdoor ozone concentration at time  $t$ , respectively [ppb],  $\varepsilon$  is the emission rate of ozone from the ESP [ $\text{mg h}^{-1}$ ],  $V_{room}$  is the volume of the office [ $\text{m}^3$ ],  $R$  is a unit conversion factor (“ $\text{mg m}^{-3}$ ” of ozone to “ppb” of ozone),  $\gamma_{filt}$  is the combined ozone removal efficiency of the mini-bag filter and the HEPA filter,  $\lambda_v$  is the air exchange rate [ $\text{h}^{-1}$ ], and  $k_d$  and  $k_h$  are the first order rate constants for ozone’s removal by indoor surfaces and human surfaces, respectively, [ $\text{h}^{-1}$ ]. The second and third terms describe sources of indoor ozone – the ESP unit and outdoor-to-indoor transport. We have assumed that the mini-bag filter and HEPA filter share equally in ozone removal, hence “ $\gamma_{filt}/2$ ” in the second term because the ESP was positioned between these two filters. The fourth to sixth terms describe the removal of ozone by ventilation, room surfaces, and human surfaces, respectively. Under steady-state conditions,  $dC_{in}(t)/dt = 0$  and the indoor ozone concentration can be calculated as:

$$C_{in}(t) = \frac{\left(1 - \frac{\gamma_{filt}}{2}\right) \cdot \frac{\varepsilon}{V_{room}} \cdot R}{\lambda_v + k_d + k_h} + \frac{(1 - \gamma_{filt}) \cdot \lambda_v \cdot C_{out}(t)}{\lambda_v + k_d + k_h}$$

**Equation 3**

eTable 3 summarizes the values measured in this study for the parameters in Equation 3 (with the exception of R, which is simply the constant used to convert “ $mg\ m^{-3}$ ” of ozone to “ppb” of ozone at 25 °C). Substituting the measured values of these parameters into Equation 3 results in a value of approximately 0.2 for the I/O ratio of O<sub>3</sub> and an additional 3 ppb of O<sub>3</sub> in the room air when the ESP is operating.

Exposure to each pollutant in a given hour was the product of either (1) the outdoor hourly mean concentration, the location-specific I/O ratio (1.0 for outdoors), and the fraction of the hour spent in that location or (2) the time spent in the location and the measured or modeled indoor concentration. The I/O ratio for unknown indoor environments was 0.35 for O<sub>3</sub> and 0.8 for PM<sub>2.5</sub>. All indoor environments were treated the same for NO<sub>2</sub> and SO<sub>2</sub>, which had assumed I/O ratios of 0.8 and 0.5, respectively. The exposures for each location within each hour were summed to account for all 60 minutes in each hour, and these hourly exposures were averaged over 24 hours to get the mean 24-hour exposure. This is summarized in the following general equation, Equation 4, in which  $E_{p_h}$  is the one-hour exposure for a given hour  $h$  and pollutant  $p$ ,  $l_i$  is location “ $i$ ” for  $n$  number of locations at which the subject spent time during that given hour,  $T_{l_i}$  and  $I:O_{pl_i}$  are the time and I/O ratios for that given location  $l$  and pollutant  $p$ , and  $C_p$  is the concentration of pollutant  $p$ :

$$E_{p_h} = \sum_{i=1}^n T_{l_i} * I:O_{pl_i} * C_p$$

**Equation 4**

### Calculations for 2-Week Exposure Measures

The 2-week exposure concentration was calculated using the average of the 4 questionnaires (1 from each visit) for each subject to get subject-specific average times in each location for each hour of the day. This was combined with modeled indoor and measured outdoor concentration data for each hour in the 312 hours before the already calculated 24-hour pre-biomarker measurement period to get a 336-hour (2-week) average exposure concentration. The exposure for a given pollutant  $p$  at a given hour  $h$  in the 25-336 hours prior to biomarker sampling was calculated using Equation 4, but with the average time spent in each location over the four questionnaires for each subject ( $\mu T_{l_i}$ ) used in place of  $T_{l_i}$ .

The aforementioned methods for estimating unknown hourly pollutant concentrations for calculating the 24-hour exposure concentrations were the same for the 2-week calculation except for those times during which subject were believed to have been away from Broad Town. For hours assumed to have been spent away, information about when the subject normally leaves Broad Town was combined with total weekly times spent in the dormitories, offices, and other environments to make an estimate of where each subject was at a given hour. Missing values for the total weekly times were substituted with the mean times for all subjects. Subjects had three consistent patterns for how often they would leave Broad Town during the week: (1) they would stay on or near the campus all week (henceforth called “L1”); (2) they would go to a different residence a short drive away from Broad Town over the weekends (henceforth called “L2”); or (3) they would leave on the weekends and also on Wednesday evenings (henceforth called “L3”).

The estimated times in each location during the weekends were calculated based on differences between the written weekly times spent in the dorms, offices, and outdoors and the sum of the assumed time spent in these environments during the week based on the questionnaire data. It was known that the subjects may have spent time outdoors and in the offices over the weekend, most likely between 8:00 AM and 8:00 PM. It was also known that the subjects may have spent time in their dorms over the weekends too, with the greatest likelihood being between 8:00 PM and 8:00 AM, but also some possibility of short visits between 8:00 AM and 8:00 PM. The differences in dorm times, office (work) times, and outdoor times are henceforth abbreviated  $\Delta T_{D_{week}}$ ,  $\Delta T_{W_{week}}$ , and  $\Delta T_{O_{week}}$ , respectively.

Based on common time-activity patterns during the weekends reported by the subjects, we assigned the unaccounted-for weekly total time spent in the dorms, offices, and outdoors ( $\Delta T_{D_{week}}$ ,  $\Delta T_{W_{week}}$ , and  $\Delta T_{O_{week}}$ ) to different blocks of time during which subjects were most likely to be in a given location. For example, if  $\Delta T_{W_{week}}$  was greater than zero, it was assumed that this time was either spent at some point between 8:00 AM - 8:00 PM just on Saturday (when  $\Delta T_{W_{week}}$  was between 0 - 8 hours) or split evenly between Saturday and Sunday from 8:00 AM - 8:00 PM (when  $\Delta T_{W_{week}}$  was between 8 - 24 hours). Though we have a good estimation of the total time spent in each time period (e.g., 12-hour daytime time period) in a given location, we are not sure exactly which hours would be spent in a given location. Therefore, each hour was weighted equally as shown in Equation 5.  $eT_{l_i}$  is the

estimated time spent in location  $l$  and  $T_t$  is the total time for that time period with unknown times in unknown locations (e.g., 12 hours for nighttime on the weekends):

$$E_{ph} = \sum_{i=1}^n \left( \frac{eT_{l_i}}{T_t} \right) * I: O_{l_i} * C_p$$

**Equation 5**

Beyond the weekends, other times that were assumed to have been spent away from Broad Town were Wednesday nights and Thursday mornings for “L3” subjects. For these Wednesday nights, it was assumed that subjects were in unknown residences after 10:00 PM and that they spent 1 hour outdoors and 3 hours in unknown indoor environments between 6:00 PM and 10:00 PM. For Thursday mornings, we assumed that subjects spent 12:00 AM – 6:00 AM in their dorms, as well as one hour outdoors and one hour in an unknown indoor environment between 6:00 AM and 8:00 AM.

Location misassignment is not expected to have a major impact on exposure assessment, especially considering that the times spent away from Broad Town were mostly concentrated in 4 days over two weekends out of the 14 day period evaluated in this two-week exposure estimation. Over the course of refining the details in these two-week exposure assessment methods, we tried multiple approaches to assign specific times at specific locations before arriving at the current approach. In none of these instances did the estimates for the associations change significance or direction. Instead, these refinements only led to slight changes in the effect sizes of the associations. The calculated exposure concentrations as well as the measured ambient concentrations can be seen in eTable 4. After calculating these exposure concentrations, all outdoor pollutant concentrations and exposure concentrations were evaluated for correlations between each other with Spearman correlation coefficients, which can be seen in eTable 5.

**Models Associating Exposure with Biomarker Responses**

Linear mixed models with subject-specific intercepts were used to assess the association between exposure concentration predictors and biomarker outcomes. All models included 24-hour ambient temperature ( $TEMP_{24h}$ ) and  $T_{SHS_{24h}}$  (time spent with secondhand smoke in the past 24 hours) as covariates in the model, as these were expected to influence biomarker outcomes. The following additional possible covariates were selected from for a given biomarker: day of the week ( $WD$ ), respiratory infection status ( $RIS$ ), menstruation status ( $MS$ ), and hours since the subject last ate ( $LA$ ). The model selection process involved starting off with the Equation 6 and removing the aforementioned four possible additional covariates one at a time, removing the covariate with highest p-value first. Only those covariates that remained significant at the 0.05 level were kept for later analysis.

$$Y_{ij} = \alpha_i + \beta_1 TEMP_{24h_{ij}} + \beta_2 T_{SHS_{24h_{ij}}} + \beta_3 WD_{ij} + \beta_4 RIS_{ij} + \beta_5 MS_{ij} + \beta_6 LA_{ij} + \epsilon_{ij}$$

**Equation 6**

In these equations  $\alpha_i$  refers to the vector of subject-specific intercepts,  $\beta$  refers to the slope estimates, and  $\epsilon_{ij}$  refers to the residual error. The overall equation used in each of the models relating exposure concentration predictors to biomarker outcomes is provided in Equation 7, where  $E_{p_t}$  is a given mean exposure measure for pollutant  $p$  over time period  $t$ .

$$Y_{ij} = \alpha_i + \beta_1 E_{p_{t_{ij}}} + \beta_2 TEMP_{24h_{ij}} + \beta_3 T_{SHS_{24h_{ij}}} + \beta_4 WD_{ij} + \beta_5 RIS_{ij} + \beta_6 MS_{ij} + \beta_7 LA_{ij} + \epsilon_{ij}$$

**Equation 7**

Information on the additional covariates used in the models for each biomarker is provided in eTable 5. The results of all single and two-pollutant models are represented as percent changes in eFigures 1 to 4. Note that EBC MDA, FeNO, EBCNN, 8-OHdG, CRP, and sCD62P were log-transformed due to being heavily right-skewed. The star notation conventions are the same with eFigures 1 to 4 as they are for Figures 1 and 2 in the main text. Namely, “\*” indicates  $p < 0.05$ , and “\*\*\*” indicates  $p < 0.05$  after Benjamini-Yekutieli multiple testing correction.

**eReferences**

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2. Huang W, Wang G, Lu SE, et al. Inflammatory and oxidative stress responses of healthy young adults to changes in air quality during the Beijing Olympics. *Am J Respir Crit Care Med.* 2012;186(11):1150-1159.

**eTable 1. Study Subject Characteristics Between Groups With Different Filtration Conditions.**

	- ESP & HEPA (n=34)	- ESP only (n=52)	p-value
Age (Mean +/- SD)	31.7 +/- 8.4	31.5 +/- 7.3	0.93
Age Range	22-52	22-52	—
Female (Number (%))	9 (26.5%)	16 (30.8%)	0.76
BMI (Mean +/- SD)	22.0 +/- 3.1	22.5 +/- 2.5	0.39
Number of Current Smokers (Number (%))	4 (11.8%)	11 (21.2%)	0.40
Number of Ex-Smokers (Number (%))	5 (14.7%)	1 (1.9%)	0.06
Pack-years for Current and Ex-Smokers (Mean +/- SD)	0.9 +/- 2.8	0.9 +/- 2.3	0.94

**eTable 2. Filtration- and Location-Specific PM<sub>2.5</sub> I/O Ratios.**

I/O Type	F8	F8 + ESP + HEPA or F8 + HEPA
Office Floor 3	—	0.1
Office Floor 4	0.6	0.3
Dorm #1	—	0.1
Dorm #2	—	0.3
Dorm #2 (Smoking)	—	0.7
Dorm #3	—	0.1
Dorm #4	—	0.3
Dorm #4 (Smoking)	—	0.7
Dorm #5	—	0.4
Dorm #6	—	0.3
Dorm #7	0.6	0.2

**eTable 3. Key Parameter Values for Estimating the Contribution of the ESP to Indoor O<sub>3</sub>.**

$\gamma_{\text{filt}}$	$\epsilon$ (mg h <sup>-1</sup> )	$V_{\text{room}}$ (m <sup>3</sup> )	$\lambda_v$ (h <sup>-1</sup> )	R (ppb mg <sup>-1</sup> m <sup>3</sup> )	$k_d$ (h <sup>-1</sup> )	$k_h$ (h <sup>-1</sup> )
0.2	28.8	960	(1 ± 0.02)	500	(2.8 ± 0.2)	(0.6 ± 0.5)

**eTable 4. Spearman Correlation Coefficients for Outdoor Pollutant Concentrations and Exposure Measures.**

	24h PM <sub>2.5</sub>	24h PM <sub>2.5</sub> Exp	2w PM <sub>2.5</sub>	2w PM <sub>2.5</sub> Exp	24h O <sub>3</sub>	24h O <sub>3</sub> Exp	2w O <sub>3</sub>	2w O <sub>3</sub> Exp	24h NO <sub>2</sub>	24h NO <sub>2</sub> Exp	2w NO <sub>2</sub>	2w NO <sub>2</sub> Exp	24h SO <sub>2</sub>	24h SO <sub>2</sub> Exp	2w SO <sub>2</sub>	2w SO <sub>2</sub> Exp
24h PM <sub>2.5</sub>	1															
24h PM <sub>2.5</sub> Exp	<b><u>0.80</u></b>	1														
2w PM <sub>2.5</sub>	0.04	-0.05	1													
2w PM <sub>2.5</sub> Exp	<b><u>0.24</u></b>	<b><u>0.48</u></b>	<b><u>0.52</u></b>	1												
24h O <sub>3</sub>	<b><u>-0.17</u></b>	-0.12	<b><u>-0.61</u></b>	<b><u>-0.26</u></b>	1											
24h O <sub>3</sub> Exp	<b><u>-0.32</u></b>	<b><u>-0.26</u></b>	<b><u>-0.49</u></b>	<b><u>-0.29</u></b>	<b><u>0.89</u></b>	1										
2w O <sub>3</sub>	<b><u>-0.20</u></b>	-0.11	<b><u>-0.79</u></b>	<b><u>-0.43</u></b>	<b><u>0.84</u></b>	<b><u>0.72</u></b>	1									
2w O <sub>3</sub> Exp	<b><u>-0.21</u></b>	<b><u>-0.16</u></b>	<b><u>-0.73</u></b>	<b><u>-0.40</u></b>	<b><u>0.81</u></b>	<b><u>0.73</u></b>	<b><u>0.92</u></b>	1								
24h NO <sub>2</sub>	<b><u>0.54</u></b>	<b><u>0.56</u></b>	<b><u>-0.57</u></b>	-0.14	<b><u>0.19</u></b>	-0.02	<b><u>0.41</u></b>	<b><u>0.34</u></b>	1							
24h NO <sub>2</sub> Exp	<b><u>0.53</u></b>	<b><u>0.56</u></b>	<b><u>-0.58</u></b>	-0.14	<b><u>0.20</u></b>	0.00	<b><u>0.41</u></b>	<b><u>0.35</u></b>	<b><u>1.00</u></b>	1						
2w NO <sub>2</sub>	<b><u>0.71</u></b>	<b><u>0.61</u></b>	<b><u>0.46</u></b>	<b><u>0.46</u></b>	<b><u>-0.47</u></b>	<b><u>-0.61</u></b>	<b><u>-0.53</u></b>	<b><u>-0.54</u></b>	<b><u>0.31</u></b>	<b><u>0.30</u></b>	1					
2w NO <sub>2</sub> Exp	<b><u>0.70</u></b>	<b><u>0.60</u></b>	<b><u>0.45</u></b>	<b><u>0.48</u></b>	<b><u>-0.47</u></b>	<b><u>-0.60</u></b>	<b><u>-0.52</u></b>	<b><u>-0.51</u></b>	<b><u>0.31</u></b>	<b><u>0.31</u></b>	<b><u>0.99</u></b>	1				
24h SO <sub>2</sub>	<b><u>0.56</u></b>	<b><u>0.50</u></b>	<b><u>-0.41</u></b>	-0.14	0.07	-0.04	0.14	0.13	<b><u>0.69</u></b>	<b><u>0.68</u></b>	<b><u>0.21</u></b>	<b><u>0.22</u></b>	1			
24h SO <sub>2</sub> Exp	<b><u>0.52</u></b>	<b><u>0.50</u></b>	<b><u>-0.41</u></b>	-0.13	0.08	-0.00	0.14	0.14	<b><u>0.68</u></b>	<b><u>0.69</u></b>	<b><u>0.19</u></b>	<b><u>0.20</u></b>	<b><u>0.98</u></b>	1		
2w SO <sub>2</sub>	<b><u>0.24</u></b>	<b><u>0.16</u></b>	<b><u>0.77</u></b>	<b><u>0.46</u></b>	<b><u>-0.86</u></b>	<b><u>-0.74</u></b>	<b><u>-0.94</u></b>	<b><u>-0.89</u></b>	<b><u>-0.38</u></b>	<b><u>-0.38</u></b>	<b><u>0.54</u></b>	<b><u>0.53</u></b>	-0.08	-0.09	1	
2w SO <sub>2</sub> Exp	<b><u>0.20</u></b>	0.13	<b><u>0.77</u></b>	<b><u>0.49</u></b>	<b><u>-0.84</u></b>	<b><u>-0.71</u></b>	<b><u>-0.94</u></b>	<b><u>-0.83</u></b>	<b><u>-0.37</u></b>	<b><u>-0.38</u></b>	<b><u>0.53</u></b>	<b><u>0.55</u></b>	-0.10	-0.10	<b><u>0.96</u></b>	1

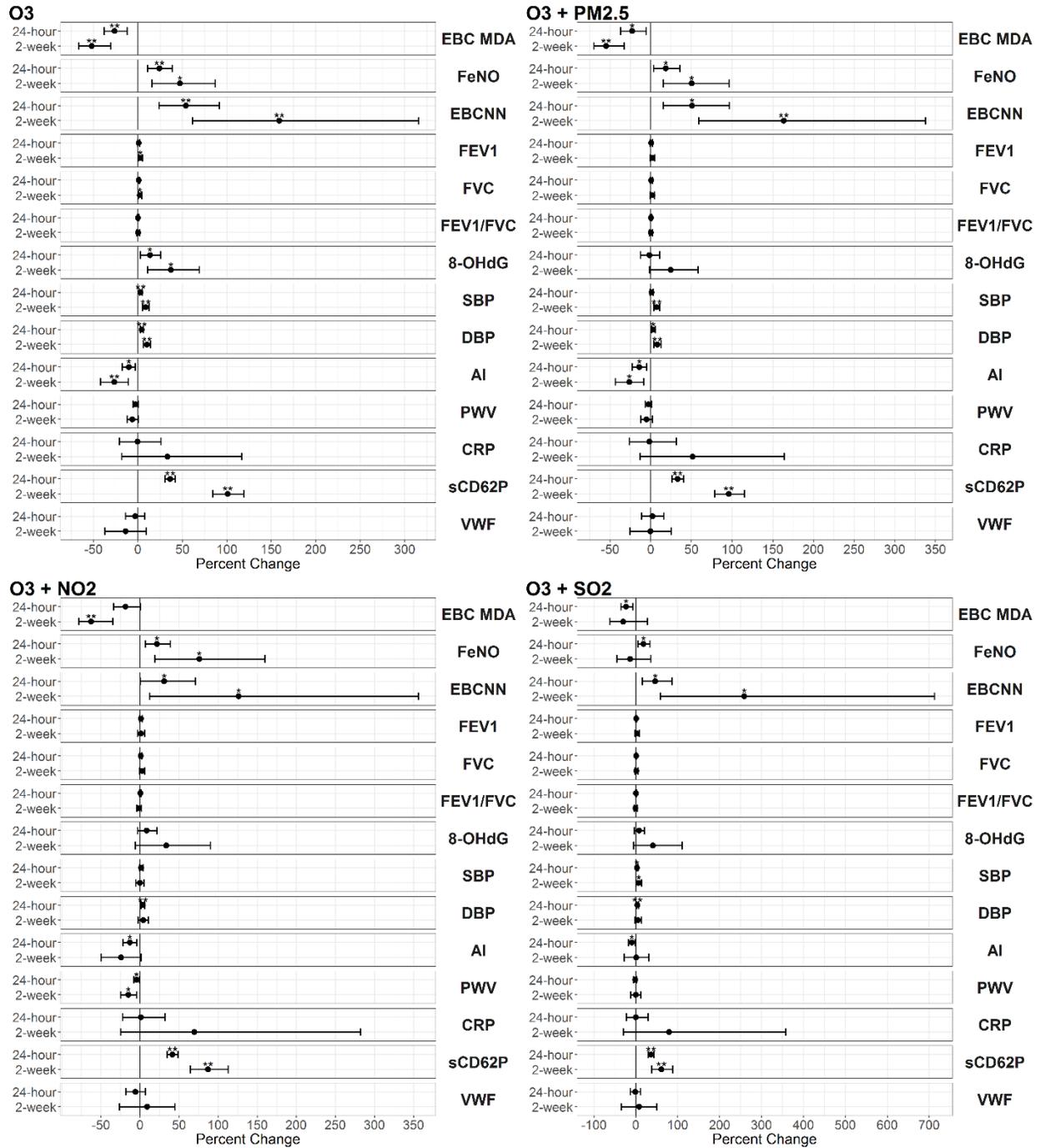
Exp here refers to the calculated mean exposure concentration for a given pollutant. Bolded and underlined Pearson coefficients have p-values < 0.05 after Benjamini-Yekutieli false discovery rate correction.

**eTable 5. Covariates Used in the Models for each Biomarker.**

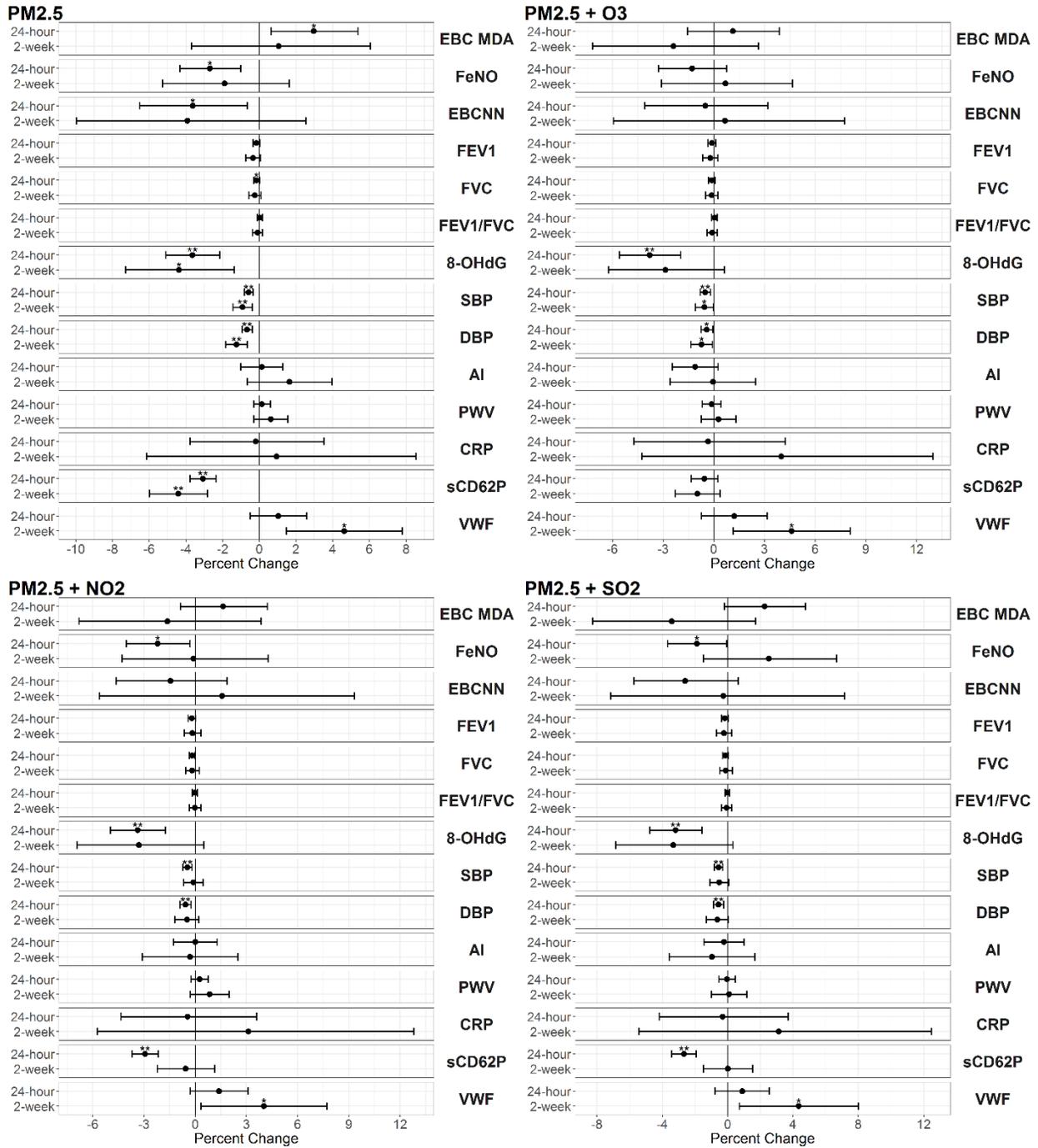
Biomarker	EBC MDA	FeNO	EBCNN	FEV <sub>1</sub>	FVC	FEV <sub>1</sub> / FVC	8-OHdG	SBP	DBP	AI	PWV	CRP	sCD62P	VWF
Covariates	WD + MS		WD			LA		WD		MS + LA			RIS + WD	WD + LA

These covariates are in addition to  $TEMP_{24h}$  and  $T_{SHS_{24h}}$ . RIS = Respiratory infection status; WD = day of the week; MS = menstruation status; LA = hours since last ate food

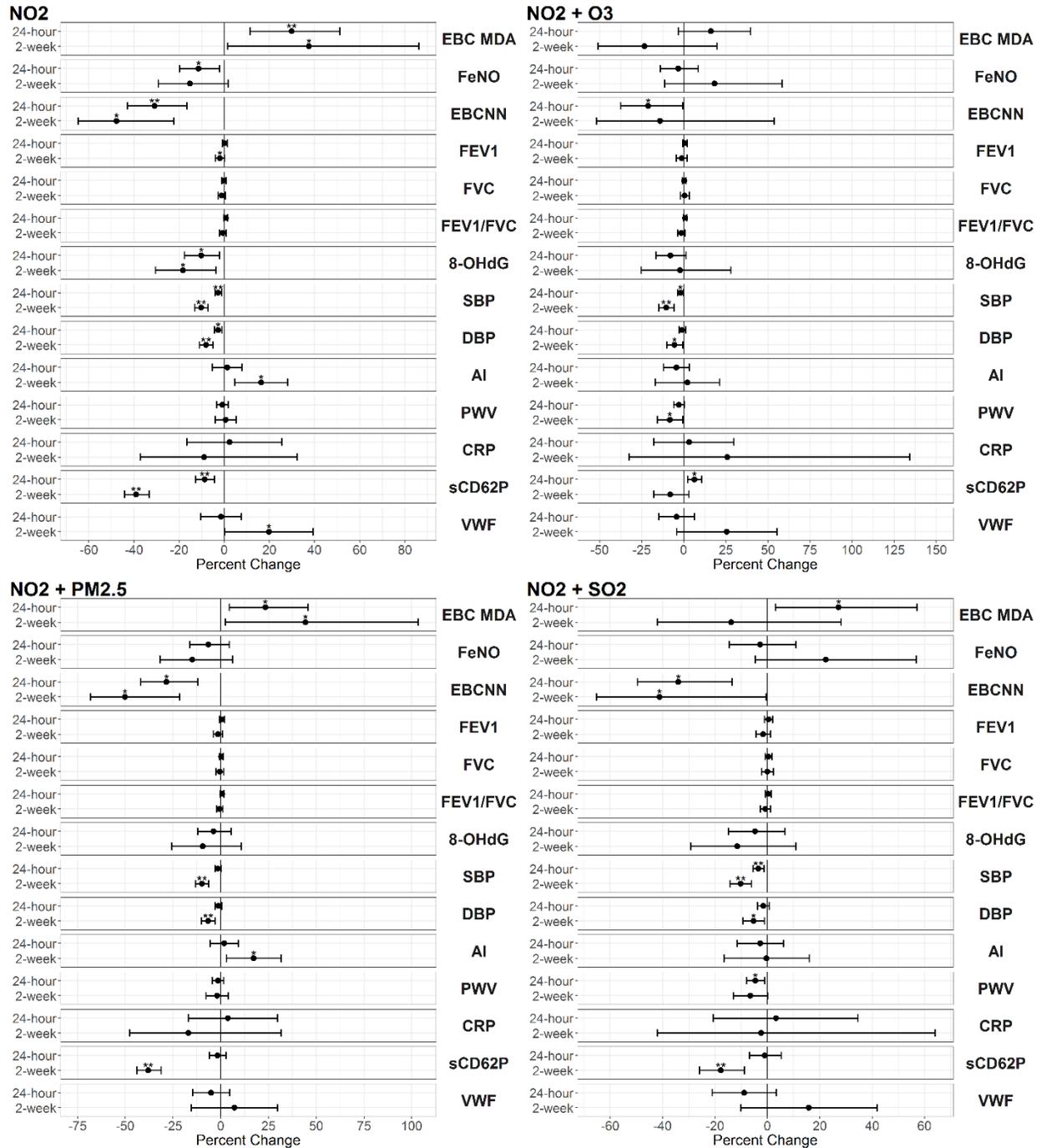
**eFigure 1. All Single and Two-Pollutant Model Results for O<sub>3</sub>.**



**eFigure 2. All Single and Two-Pollutant Model Results for PM<sub>2.5</sub>.**



**eFigure 3. All Single and Two-Pollutant Model Results for NO<sub>2</sub>.**



**eFigure 4. All Single and Two-Pollutant Model Results for SO<sub>2</sub>.**

