**SUPPLEMENTAL TABLES AND FIGURES**

**Table S1.** Absolute difference in proportions of PTB pre-intervention versus post-intervention to reduce SO2 emissions at CFPPs in NC for CFPP-scrubber, CFPP-retired, and CFPP-all: overall, stratified by early and moderate-to-late PTB, and stratified by gestational parent race/ethnicity.

**Table S2.** Sensitivity Analyses: Absolute difference in proportions of PTB pre-intervention versus post-intervention to reduce SO2 emissions at 14 largest CFPPs in NC (pooled analyses).

**Table S3.** Sensitivity Analyses: Absolute difference in proportions of PTB pre-intervention versus post-intervention to reduce SO2 emissions at 14 largest CFPPs in NC (plant-specific analyses).

**Table S4.** Distance between gestational parent home address at time of delivery and nearest CFPP, among gestational parents living <4 miles, by race/ethnicity

**Figure S1.** Flowchart for study population inclusion and exclusion

**Figure S2.** Distance (in miles) between the 14 largest CFPPs in North Carolina

**Figure S3.** Monthly SO2 emissions (tons) reported by each CFPP. A) CFPP-scrubber. B) CFPP-retired. C) and D) show boxplots of monthly SO2 emissions by 1 year pre- and post- intervention exposure windows. (For CFPP-retired, monthly SO2 emissions were 0 tons in the post-intervention period for Riverbend and essentially 0 tons for the other 6 CFPPs within CFPP-retired.)

**Figure S4**. Annual preterm birth prevalence nearby CFPP-GG Allen by distance buffer (0-<4 miles, 4-<10 miles, and 10-<15 miles) prior to installation of scrubbers in 2009

**Figure S5**. Unadjusted annual trends in means for key gestational parent sociodemographic characteristics by distance buffers (0-<4 miles, 4-<10 miles, and 10-<15 miles) nearby CFPP-GG Allen prior to installation of scrubbers in 2009

**Figure S6.** Meta-Analysis for CFPPs. Absolute difference in proportions of PTB pre-intervention versus post-intervention to reduce SO2 emissions at CFPPs in NC by individual CFPP as well as grouped by CFPP-scrubber, CFPP-retired, and CFPP-all. Fixed = fixed effects. Random = random effects. Distance categories are 0 miles to less than 4 miles (grey circles) and 4 miles to less than 10 miles (black triangles), compared to 10 miles to less than 15 miles.

**Table S1.** Absolute difference in proportions of PTB pre-intervention versus post-intervention to reduce SO2 emissions at CFPPs in NC for CFPP-scrubber, CFPP-retired, and CFPP-all: overall, stratified by early and moderate-to-late PTB, and stratified by gestational parent race/ethnicity.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **CFPP-scrubber** | | | | | **CFPP-retired** | | | | | **CFPP-all** | | | | |
| **0-<4 miles** | | **4-<10 miles** | | **N for 10-<15 miles** | **0-<4 miles** | | **4-<10 miles** | | **N for 10-<15 miles** | **0-<4 miles** | | **4-<10 miles** | | **N for 10-<15 miles** |
| **N**a | **DiD  (95% CI)** | **N** | **DiD  (95% CI)** | **N** | **DiD  (95% CI)** | **N** | **DiD  (95% CI)** | **N** | **DiD  (95% CI)** | **N** | **DiD  (95% CI)** |
| **PTB (dicotomous)** | 1,892  171 | 0.015  (-0.010, 0.040) | 15,268  1,546 | -0.015  (-0.026,  -0.004) | 21,246  2,108 | 2,734  256 | 0.003  (-0.018, 0.025) | 15,022 1,361 | -0.005  (-0.016, 0.006) | 20,071 1,774 | 4,626 427 | 0.007  (-0.009, 0.023) | 30,290 2,907 | -0.010  (-0.018,  -0.002) | 41,317 3,882 |
| **PTB (polytomous)** | | | | | | | | | | | | | | | |
| Early PTB | 1,892  29 | 0.003  (-0.008, 0.014) | 15,268 237 | -0.001  (-0.006, 0.004) | 21,246 372 | 2,734  45 | 0.002  (-0.008, 0.012) | 15,022 221 | -0.004  (-0.008, 0.001) | 20,071  279 | 4,626  74 | 0.002  (-0.005, 0.010) | 30,290 458 | -0.002  (-0.006, 0.001) | 41,317  651 |
| Moderate-to-late PTB | 1,892  142 | 0.012  (-0.011, 0.035) | 15,268  1,309 | -0.014  (-0.025,  -0.004) | 21,246  1,736 | 2,734  211 | 0.002  (-0.018, 0.022) | 15,022  1,140 | -0.002  (-0.012, 0.009) | 20,071  1,495 | 4,626 353 | 0.005  (-0.010, 0.020) | 30,290  2,449 | -0.008  (-0.015, 0.000) | 41,317  3,231 |
| **Gestational parent race/ethnicity** | | | | | | | | | | | | | | | |
| American Indian, nHb | 10 0 | --- | 46 5 | --- | 51 7 | 148 16 | --- | 311 46 | --- | 509 56 | 158 16 | --- | 357 51 | --- | 560 63 |
| Asian, nHc | 82 4 | -0.040  (-0.139, 0.058) | 532 46 | -0.082  (-0.141,  -0.024) | 688 46 | 55 1 | --- | 438 31 | --- | 1,068 85 | 137 5 | --- | 970 77 | --- | 1,756 131 |
| Black, nH | 182 28 | 0.019  (-0.075, 0.112) | 3,427  492 | -0.004  (-0.032, 0.023) | 4,884 736 | 817  112 | 0.019  (-0.027, 0.064) | 4,118 504 | 0.003  (-0.022, 0.028) | 4,504  571 | 999 140 | 0.011  (-0.029, 0.052) | 7,545  996 | -0.002  (-0.020, 0.017) | 9,388 1307 |
| Hispanic | 232 18 | 0.070  (0.006, 0.134) | 2,436  210 | -0.000  (-0.026, 0.026) | 3,763  316 | 337 21 | 0.014  (-0.038, 0.066) | 1,998 145 | 0.000  (-0.026, 0.027) | 3,370 241 | 569 39 | 0.036  (-0.004, 0.076) | 4,434 355 | -0.000  (-0.019, 0.018) | 7,133 557 |
| white, nH | 1,386  121 | 0.007  (-0.022, 0.036) | 8,800 790 | -0.020  (-0.034,  -0.006) | 11,831 1,000 | 1,367  105 | -0.001  (-0.029, 0.026) | 8,122 631 | -0.008  (-0.023, 0.006) | 10,576  817 | 2,753  226 | 0.002  (-0.018, 0.022) | 16,922 1,421 | -0.014  (-0.024,  -0.004) | 22,407 1,817 |
| other, nH/ unknown | 0 0 | --- | 27 3 | --- | 29 3 | 10 1 | --- | 35 4 | --- | 44 4 | 10 1 | --- | 62 7 | --- | 73 7 |
| other, nH/ unknownd | 92 4 | -0.045  (-0.133, 0.043) | 605 54 | -0.086  (-0.143,  -0.030) | 768 56 | 213 18 | --- | 784 81 | --- | 1,621 145 | 305 22 | -0.019  (-0.074, 0.036) | 1,389 135 | -0.040  (-0.075,  -0.005) | 2,389 201 |

aN = sample size within that distance buffer for controls (top) and cases (bottom)

bModel convergence issues for CFPP-scrubber, CFPP-retired, and CFPP-all. For CFPP-retired, n=957 (88%) of births are nearby WH Weatherspoon.

cModel convergence issues for CFPP-retired. n=1,296 (77%) of births are nearby Riverbend.

dAmerican Indian, nH; Asian, nH; other, nH; unknown collasped together due to convergence issues when stratified.

Abbreviations: CFPP = coal-fired power plants; DID = difference-in-differences estimate; LCI = Lower 95% Confidence Interval; UCL = Upper 95% Confidence Interval; early PTB = 20 to <32 weeks completed gestation ; moderate-to-late PTB = 32 to <37 weeks completed gestation; nH = non-Hispanic

**Table S2.** Sensitivity Analyses: Absolute difference in proportions of PTB pre-intervention versus post-intervention to reduce SO2 emissions at 14 largest CFPPs in NC (pooled analyses).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **PTB (dicotomous)** | **CFPP-scrubber** | | | | | **CFPP-retired** | | | | | **CFPP-all** | | | | |
| **0-<4 miles** | | **4-<10 miles** | | **N for 10-<15 miles** | **0-<4 miles** | | **4-<10 miles** | | **N for 10-<15 miles** | **0-<4 miles** | | **4-<10 miles** | | **N for 10-<15 miles** |
| **N** a | **DiD (95% CI)** | **N** | **DiD (95% CI)** | **N** | **DiD (95% CI)** | **N** | **DiD (95% CI)** | **N** | **DiD (95% CI)** | **N** | **DiD (95% CI)** |
| **Main Analysis for comparison** | 1,892  171 | 0.015  (-0.010, 0.040) | 15,268  1,546 | -0.015  (-0.026, -0.004) | 21,246  2,108 | 2,734  256 | 0.003 (-0.018, 0.025) | 15,022  1,361 | -0.005  (-0.016, 0.006) | 20,071  1,774 | 4,626 427 | 0.007 (-0.009, 0.023) | 30,290  2,907 | -0.010 (-0.018, -0.002) | 41,317  3,882 |
| Sensitivity Analysis - ADJUSTED 1b | 1,892  171 | 0.014  (-0.010, 0.039) | 15,259  1,546 | -0.015 (-0.026, -0.004) | 21,241  2,108 | 2,734  256 | 0.003 (-0.018, 0.024) | 15,019  1,359 | -0.005 (-0.016, 0.006) | 20,061  1,773 | 4,626  427 | 0.007 (-0.009, 0.023) | 30,278  2,905 | -0.010 (-0.018, -0.002) | 41,302  3,881 |
| Sensitivity Analysis - ADJUSTED 2c | 1,892  171 | 0.014  (-0.010, 0.039) | 15,259 1,546 | -0.015 (-0.026 -0.004) | 21,240  2,108 | 2,734  256 | 0.002 (-0.019, 0.022) | 15,019  1,359 | -0.005 (-0.016, 0.005) | 20,061  1,773 | 4,626  427 | 0.007 (-0.009, 0.022) | 30,278  2,905 | -0.010 (-0.017, -0.002) | 41,301  3,881 |
| Sensitivity Analysis - ADJUSTED 3d | 1,891  171 | 0.016  (-0.009, 0.040) | 15,252  1,546 | -0.014 (-0.025, -0.003) | 21,225  2,107 | 2,734  256 | 0.002  (-0.019, 0.022) | 15,016  1,359 | -0.005 (-0.016, 0.005) | 20,054  1,773 | 4,625 427 | 0.007 (-0.008, 0.023) | 30,268  2,905 | -0.010 (-0.017, -0.002) | 41,279  3,880 |
| Sensitivity Analysis - Fixed effect meta-analysis | 1,892  171 | 0.012  (-0.013, 0.037) | 15,268  1,546 | -0.016 (-0.027, -0.004) | 21,246  2,108 | 2,734  256 | -0.001 (-0.024, 0.021) | 15,022  1,361 | -0.006 (-0.018, 0.006) | 20,071  1,774 | 4,626  427 | 0.005 (-0.012, 0.022) | 30,290  2,907 | -0.011 (-0.019, -0.003) | 41,317  3,882 |
| Sensitivity Analysis - Random effects meta-analysis | 1,892  171 | 0.014 (-0.013, 0.042) | 15,268  1,546 | -0.016 (-0.027, -0.004) | 21,246  2,108 | 2,734  256 | -0.001 (-0.024, 0.021) | 15,022  1,361 | -0.006 (-0.018, 0.006) | 20,071  1,774 | 4,626  427 | 0.005 (-0.012, 0.022) | 30,290  2,907 | -0.011 (-0.019, -0.003) | 41,317  3,882 |
| Sensitivity Analysis -Removed observations from comparison group (10-<15 mi) that are within 15 mi of CFPP-all | 1,892  171 | 0.013 (-0.013, 0.038) | 15,268  1,546 | -0.017 (-0.029, -0.004) | 13,703  1,299 | 2,734  256 | 0.001 (-0.021, 0.023) | 15,022  1,361 | -0.008 (-0.020, 0.005) | 11,808  1,000 | 4,626  427 | 0.004 (-0.012, 0.021) | 30,290  2,907 | -0.012 (-0.021, -0.003) | 25,511  2,299 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

aN = sample size within that distance buffer for controls (top) and cases (bottom)

bModels adjusted for race/ethnicity (Black, nH; Hispanic; white, nH; other, nH/ unknown), marital status (yes; no), Medicaid status (yes; no).

cModels adjusted for race/ethnicity (Black, nH; Hispanic; white, nH; other, nH/ unknown), marital status (yes; no), Medicaid status (yes; no), maternal age (quadratic).

dModels adjusted for race/ethnicity (Black, nH; Hispanic; white, nH; other, nH/ unknown), marital status (yes; no), Medicaid status (yes; no), maternal age (quadratic), parity (1st live birth; 2nd live birth; 3rd+ live birth).

Abbreviations: CFPP = coal-fired power plants; DID = difference-in-differences estimate; LCI = Lower 95% Confidence Interval; UCL = Upper 95% Confidence Interval; nH = non-Hispanic

**Table S3.** Sensitivity Analyses: Absolute difference in proportions of PTB pre-intervention versus post-intervention to reduce SO2 emissions at the 14 largest CFPPs in NC (plant-specific analyses).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CFPP** | **0-<4 miles  vs 10-<15 miles** | | **4-<10 miles vs 10-<15 miles** | | **10-<15 miles** |
| **N for**  **0-<4: controls cases** | **DiD (95% CI)** | **N for**  **4-<10: controls cases** | **DiD (95% CI)** | **N for 10-<15: controls cases** |
| **CFPP-scrubber: Plant Name (electricity generation capacity in MW)** | | | | |  |
| **Roxboro (2,422 MW) &   Mayo (727 MW)** | 49 9 | 0.075 (-0.123, 0.272) | 496 60 | -0.009 (-0.093, 0.075) | 248 24 |
| **Belews (2,240 MW)** | 82 10 | 0.142 (0.015, 0.270) | 975 109 | -0.017 (-0.058, 0.024) | 3,236 364 |
| **Marshall (2,090 MW)** | 250 18 | -0.006 (-0.068, 0.056) | 2,253 182 | -0.012 (-0.039, 0.015) | 3,768 344 |
| **GG Allen (1,140 MW)** | 660 49 | -0.005 (-0.044, 0.034) | 8,029 837 | -0.020 (-0.036, -0.004) | 10,569 1,038 |
| **Cliffside (819 MW)a** | 128 10 | 0.059 (-0.029, 0.147) | 706 67 | -0.017 (-0.069, 0.035) | 1,096 122 |
| **Asheville (376 MW)** | 723 75 | 0.013 (-0.033, 0.059) | 2,809 291 | -0.007 (-0.037, 0.023) | 2,329 216 |
| **CFPP-retired: Plant Name (electricity generation capacity in MW)** | | | | |  |
| **LV Sutton (575 MW)b** | 343 26 | -0.035 (-0.094, 0.023) | 3,462 313 | -0.022 (-0.054, 0.010) | 1,310 104 |
| **Riverbend (454 MW)** | 696 58 | -0.004 (-0.043, 0.036) | 6,006 534 | -0.001 (-0.018, 0.016) | 10,892  996 |
| **HF Lee (382 MW)b** | 213 13 | -0.010 (-0.077, 0.057) | 1,957 148 | -0.002 (-0.038, 0.035) | 1,103 86 |
| **Cape Fear (316 MW)** | 33 9 | -0.125 (-0.369, 0.119) | 373 31 | -0.012 (-0.066, 0.043) | 3,484 283 |
| **Dan River (276 MW)b** | 431 45 | 0.003 (-0.065, 0.072) | 568 59 | -0.015 (-0.078, 0.049) | 999 42 |
| **Buck (256 MW)b** | 232 24 | 0.027 (-0.050, 0.105) | 1,933 213 | -0.007 (-0.042, 0.029) | 1,717 165 |
| **Weatherspoon (171 MW)** | 786 81 | 0.024 (-0.027, 0.075) | 723  89 | -0.003 (-0.057, 0.051) | 1,048 98 |
|  |  |  |  |  |  |

a Cliffside had a capacity of 819 MW prior to start of new coal electricity generating unit with desulfurization equipment (scrubbers) installed upon start of unit operation, which increased capacity to 1,387 MW.

b  CFPP transitioned to natural gas-fired power plant upon retirement of coal EGUs

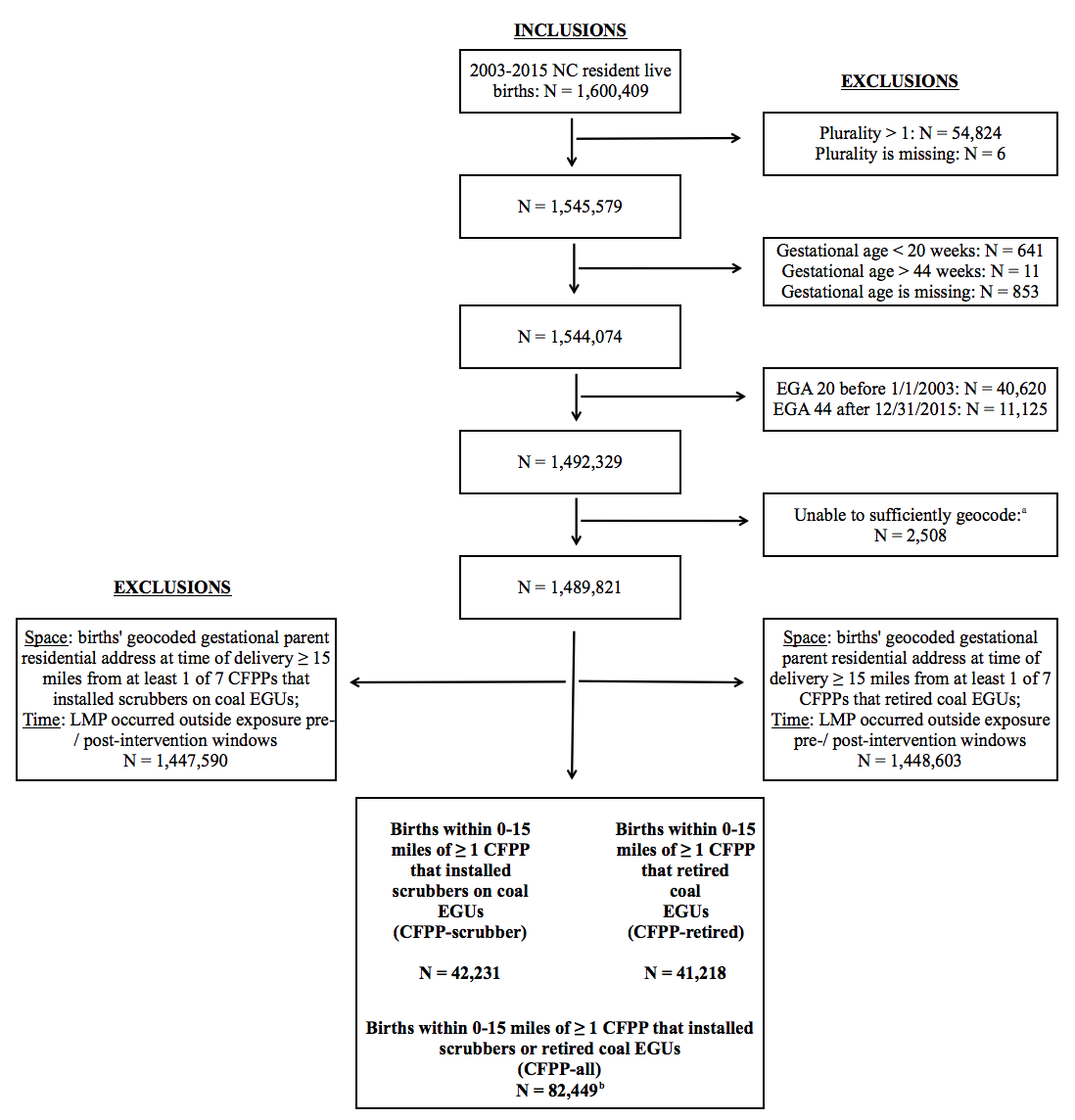
Abbreviations: CFPP = coal-fired power plants; MW= megawatt; DiD = difference-in-differences estimate; LCI = Lower 95% Confidence Interval; UCL = Upper 95% Confidence Interval

**Table S4.** Distance between gestational parent home address at time of delivery and nearest CFPP, among gestational parents living <4 miles, by race/ethnicity

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Distance in miles** | | | | | |
|
| **CFPP-scrubber** | | |  | **CFPP-retired** | |
| **N** | **Mean (SD)** | **Median (IQR)** | **N** | **Mean (SD)** | **Median (IQR)** |
|
| **Overall** | 2,063 | 2.6 (0.9) | 2.8 (1.9, 3.5) | 2,990 | 3.0 (0.7) | 3.2 (2.5, 3.6) |
| **GP race/ethnicity** |  |  |  |  |  |  |
| American Indian, nH | 10 | 2.4 (1.0) | 2.3 (1.3, 3.5) | 164 | 2.8 (0.7) | 2.9 (2.3, 3.2) |
| Asian/Pacific Islander, nH | 86 | 2.6 (0.9) | 2.6 (2.1, 3.5) | 56 | 2.9 (0.9) | 3.1 (2.3, 3.6) |
| Black, nH | 210 | 2.8 (0.9) | 2.9 (2.2, 3.6) | 929 | 3.1 (0.7) | 3.2 (2.8, 3.5) |
| Hispanic, regardless of race | 250 | 2.6 (1.0) | 2.8 (1.6, 3.5) | 358 | 3.0 (0.8) | 3.2 (2.7, 3.6) |
| white, nH | 1,507 | 2.6 (0.9) | 2.7 (1.9, 3.5) | 1,472 | 2.9 (0.8) | 3.1 (2.4, 3.6) |
| other, nH / unknown | 0 | --- | --- | 11 | 3.3 (0.8) | 3.5 (2.5, 3.9) |

Abbreviations: CFPP = coal-fired power plants; N = sample size within 0-<4 mile distance bin; SD = standard deviation; IQR = interquartile range; GP = gestational parent; nH = non-Hispanic.

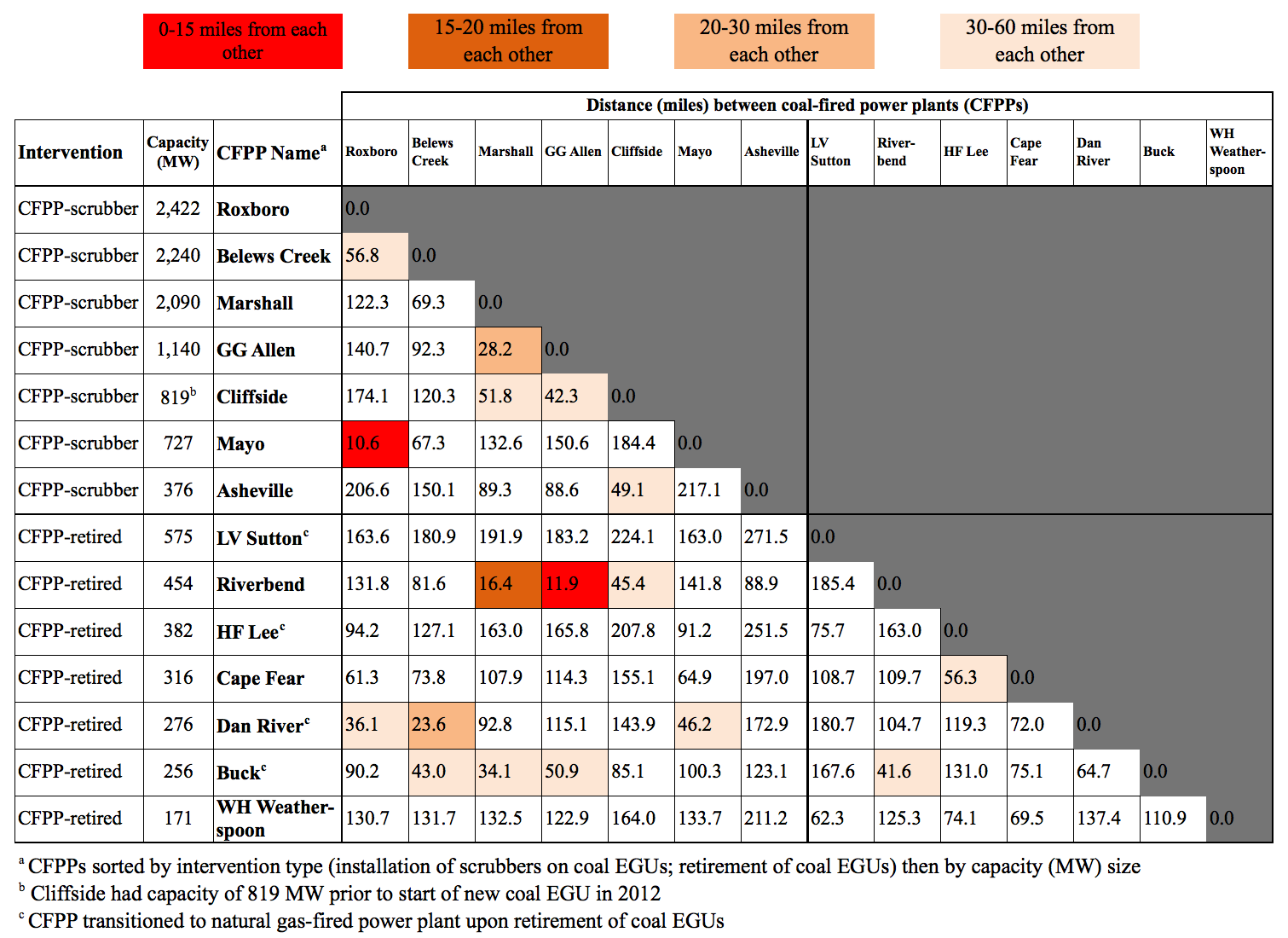
**Figure S1.** Flowchart for study population inclusion and exclusion

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aThese observations either 1) were not geocoded; 2) could only be geocoded at a locality, subadmin, or admin level; 3) were geocoded outside of NC.

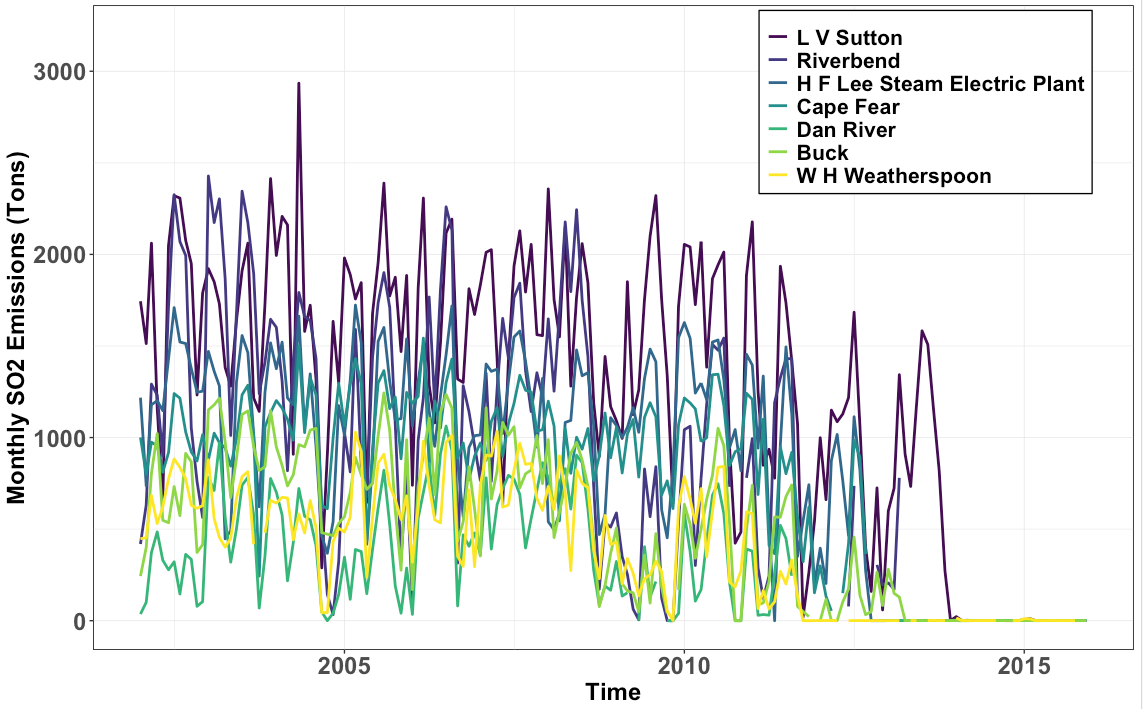
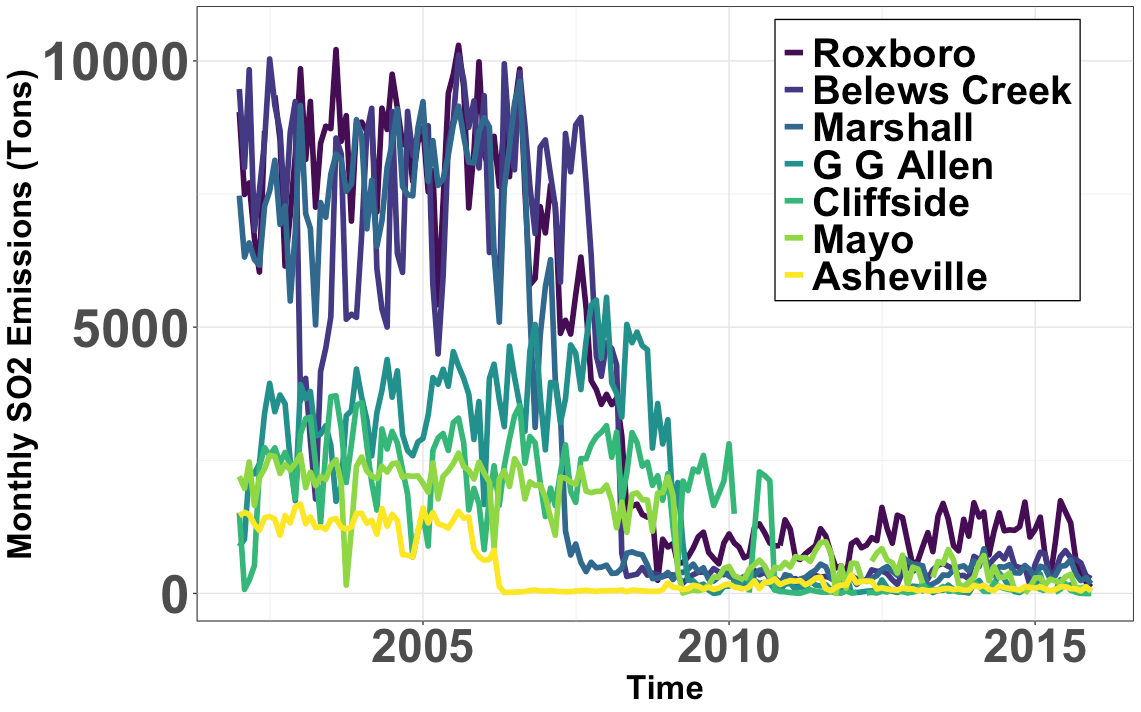
bThe observations within CFPP-scrubber and CFPP-retired are not mutually exclusive.

**Figure S2.** Distance (in miles) between the 14 largest CFPPs in North Carolina

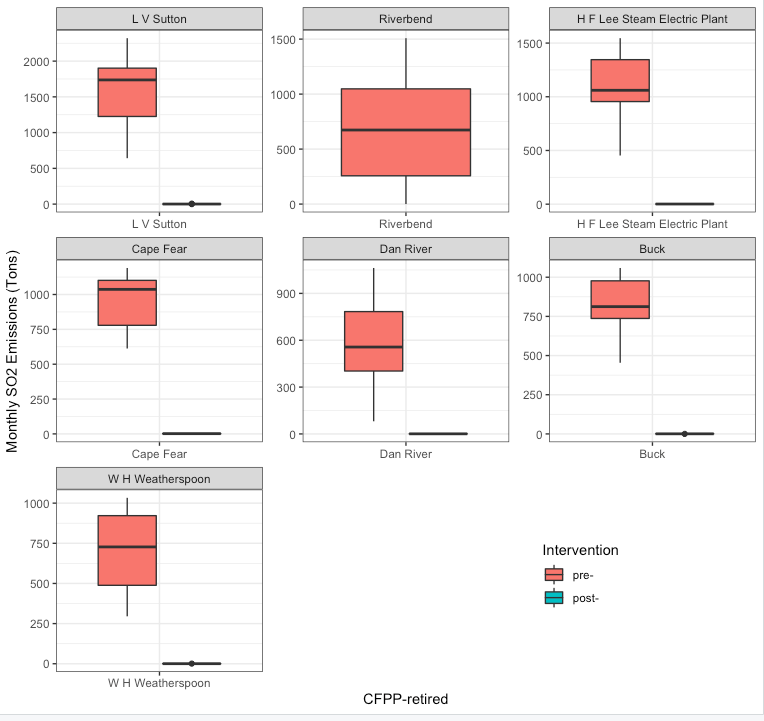
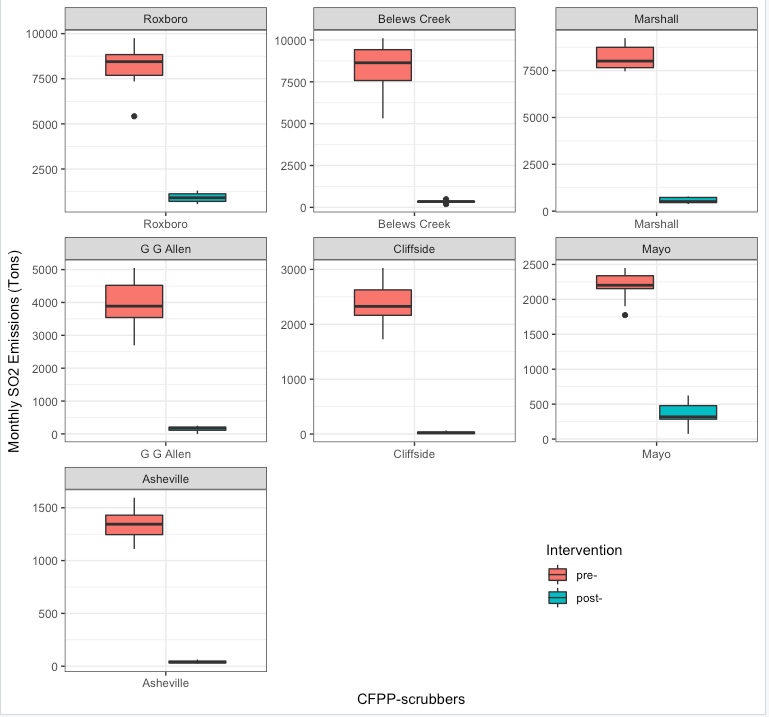
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**Figure S3.** Monthly SO2 emissions (tons) reported by each CFPP. A) CFPP-scrubber. B) CFPP-retired. C) and D) show boxplots of monthly SO2 emissions by 1 year pre- and post- intervention exposure windows. (For CFPP-retired, monthly SO2 emissions were 0 tons in the post-intervention period for Riverbend and essentially 0 tons for the other 6 CFPPs within CFPP-retired.)

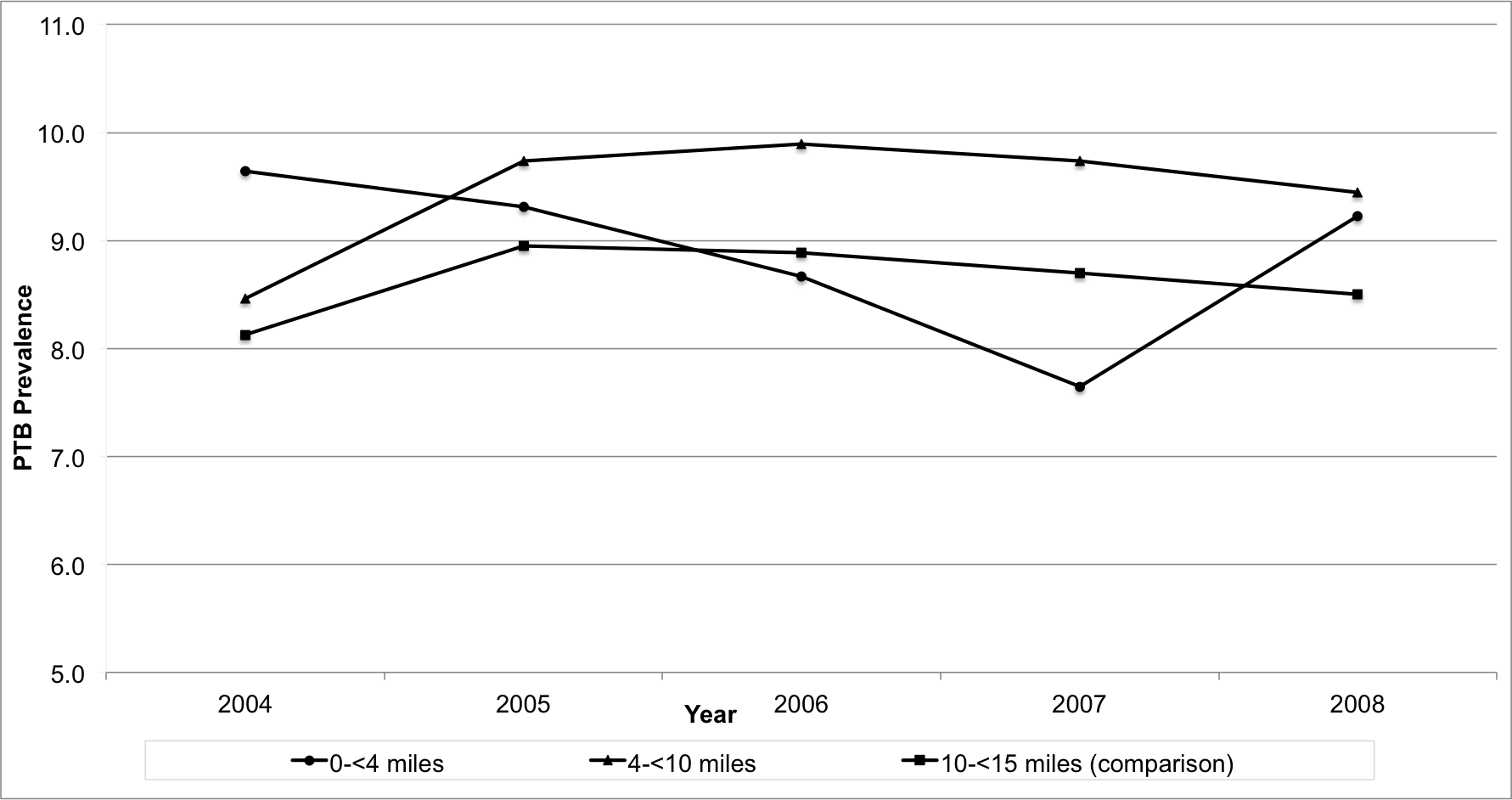
A. B.



C. D.

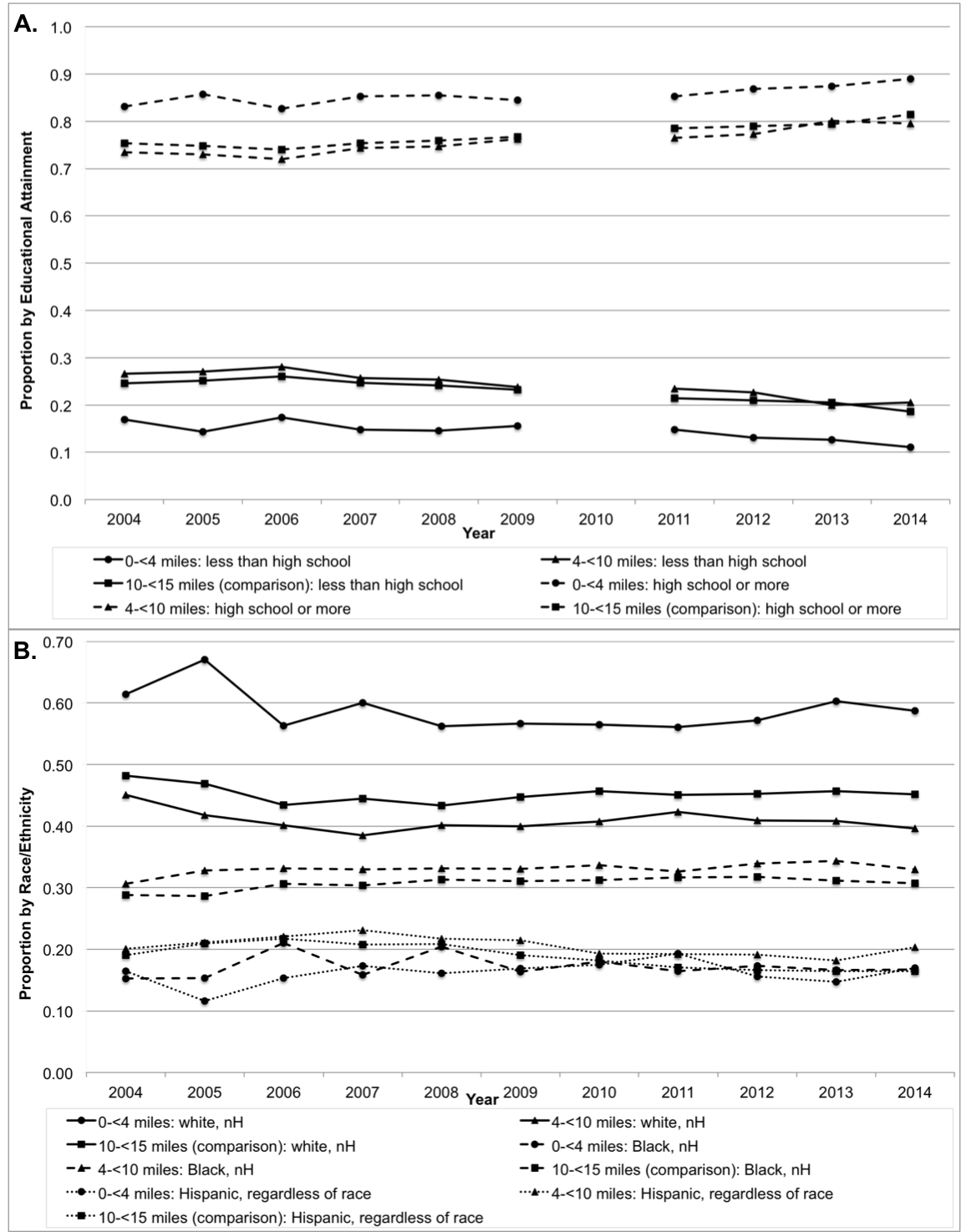


**Figure S4**. Annual preterm birth prevalence nearby CFPP-GG Allen by distance buffer (0-<4 miles, 4-<10 miles, and 10-<15 miles) prior to installation of scrubbers in 2009

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Each point is an unadjusted prevalence for preterm birth by birth year and distance between CFPP-GG Allen and gestational parent residence. CFPP-GG Allen had its first scrubber installed February 2009.

**Figure S5**. Unadjusted annual trends in means for key gestational parent sociodemographic characteristics by distance buffers (0-<4 miles, 4-<10 miles, and 10-<15 miles) nearby CFPP-GG Allen prior to installation of scrubbers in 2009

****

Each point is an unadjusted mean proportion for that characteristic (A. gestational parent educational attainment, B. gestational parent race/ethnicity) by birth year and distance buffer between CFPP-GG Allen and gestational parent residence. CFPP-GG Allen had its first scrubber installed February 2009 and the final scrubber installed May 2009. The 1-year last menstrual period (LMP) for the post-intervention exposure period began September 1, 2009 and ended August 31, 2010 (making the possible range of live births occurring between February 2010 and July 2011). The 1-year LMP for the pre-intervention exposure period began September 1, 2006 and ended August 31, 2007 (making the possible range of live births occurring between February 2007 and July 2008). Educational attainment is missing from records for births in 2010.

**Figure S6.** Meta-Analysis for CFPPs. Absolute difference in proportions of PTB pre-intervention versus post-intervention to reduce SO2 emissions at CFPPs in NC by individual CFPP as well as grouped by CFPP-scrubber, CFPP-retired, and CFPP-all. Fixed = fixed effects. Random = random effects. Distance categories are 0 miles to less than 4 miles (grey circles) and 4 miles to less than 10 miles (black triangles), compared to 10 miles to less than 15 miles.

