

## Criticism of EPA-452/P-19-001 September 2019 Policy Assessment for the Review of the National Ambient Air Quality Standards for Particulate Matter, External Review Draft

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I am herewith submitting to the EPA Clean Air Scientific Advisory Committee (CASAC) detailed criticism of EPA-452/P-19-001 [EPA Policy Assessment for the Review of the National Ambient Air Quality Standards for Particulate Matter \(External Review Draft - September 2019\)](#) (2019 PM PA). The 2019 PM PA is severely flawed because it does not address the concerns of the April 11, 2019 [CASAC Review of the EPA's Integrated Science Assessment for Particulate Matter \(External Review Draft – October 2018\)](#) (Cox 2019) regarding EPA/600/R-18/179 [US EPA Integrated Science Assessment \(ISA\) for Particulate Matter \(External Review Draft\) October 2018](#) (2018 PM ISA). To illustrate the severe flaws in 2019 PM PA, I focus on the “All-cause mortality” portion of Figure 3-3 within Section 3.2.3 PM2.5 Concentrations in Key Studies Reporting Health Effects of Chapter 3 REVIEW OF THE PRIMARY STANDARDS FOR PM2.5 of the 2019 PM PA. A key sentence on page 3-52 states “To evaluate the PM2.5 air quality distributions in key studies in this review, we first identify the epidemiologic studies assessed in the draft ISA that have the potential to be most informative in reaching conclusions on the primary PM2.5 standards.” Unfortunately, Figure 3-3 on page 3-54 does not properly describe the results from the nine US prospective cohort studies of PM2.5 and total mortality. As I document below, the answer is NO to the question in the title of this essential 2017 article: [“Do causal concentration–response functions exist? A critical review of associational and causal relations between fine particulate matter and mortality”](#) in *Critical Reviews in Toxicology* by CASAC Chair Louis Anthony (Tony) Cox Jr (Cox 2017). My criticism is divided into the five sections below.

### 1. 2019 PM PA Obscures the Null Relationship Between PM2.5 and Total Mortality in the US

Figure 3-3 of 2019 PM PA deliberately misrepresents the US epidemiologic evidence on the relationship of PM2.5 to total (all cause) mortality and obscures the null relationship that exists in a proper meta-analysis of the nine major US cohort studies with published findings. Particularly troubling to me is the unjustified omission from the 2019 PM PA of my March 28, 2017 [“Fine Particulate Matter and Total Mortality in Cancer Prevention Study Reanalysis”](#) in *Dose-Response* (Enstrom 2017) and my May 29, 2018 [“Response to Criticism”](#) in *Dose-Response* (Enstrom 2018). My seminal reanalysis of ACS CPS II identified major flaws in [Pope 1995](#), the key study underlying the 1997 PM NAAQS. Instead of properly examining the detailed findings in my reanalysis, SECTION 11.2: Long-Term PM2.5 Exposure and Total Mortality of the 2018 PM ISA dismissed my reanalysis in two *inaccurate* sentences: “A recent reanalysis of early ACS results observed a null association between county-level averages of PM2.5 measured by the Inhalable Particle Network between 1979 and 1983 and deaths between 1982 and 1988 (HR: 1.01; 95% CI: 1.00, 1.02) (Enstrom, 2017). Inconsistencies in the results could be due to the use of 85 counties in the ACS analysis by Enstrom (2017) and 50 Metropolitan Statistical Areas in the original ACS analysis (Pope et al., 1995).”

A proper meta-analysis of the relationship between PM2.5 and total mortality in nine US cohort studies is given in the September 28, 2018 Intrepid Insight (II) article "[Statistical Review of Competing Findings in Fine Particulate Matter and Total Mortality Studies](#)".

**II Table B3: Intrepid Insight Computation of Fixed and Random Effects Meta-Analysis Nine US Cohorts That Analyzed Ambient Fine Particulate Matter (PM2.5) and Total (All-cause) Mortality Relative Risk (RR and 95% CI) of Total Mortality Associated with Increase of 10 µg/m<sup>3</sup> in PM2.5**

| US Cohort Studies   | Author      | Year | RR Table | F-U Years | RR           | 95%CI(L)     | 95%CI(U)     |
|---|-------------|------|----------|-----------|--------------|--------------|--------------|
| Veterans Study  | Lipfert     | 2000 | T6       | 1986-1996 | 0.890        | 0.850        | 0.950        |
| Medicare (MCAPS) Eastern US                                     | Zeger       | 2008 | T3       | 2000-2005 | 1.068        | 1.049        | 1.087        |
| Medicare (MCAPS) Central US                                     | Zeger       | 2008 | T3       | 2000-2005 | 1.132        | 1.095        | 1.169        |
| Medicare (MCAPS) Western US                                     | Zeger       | 2008 | T3       | 2000-2005 | 0.989        | 0.970        | 1.008        |
| ACS Cancer Prevention Study (CPS II)                            | HEI RR140   | 2009 | T34      | 1982-2000 | 1.028        | 1.014        | 1.043        |
| Nurses Health Study   | Puett       | 2009 | T3       | 1992-2002 | 1.260        | 1.020        | 1.540        |
| Health Professionals FU Study                                   | Puett       | 2011 | T2       | 1989-2002 | 0.860        | 0.720        | 1.020        |
| Harvard Six Cities Study (H6CS)                                 | Lepeule     | 2012 | T2       | 1974-2009 | 1.140        | 1.070        | 1.220        |
| Agricultural Health Study                                       | Weichenthal | 2015 | T2       | 1993-2009 | 0.950        | 0.760        | 1.200        |
| NIH-AAPR Diet and Health Study                                  | Thurston    | 2016 | T2 F3    | 2000-2009 | 1.025        | 1.000        | 1.049        |
| National Health Interview Survey                                | Parker      | 2018 | T3corr   | 1997-2011 | 1.016        | 0.979        | 1.054        |
| <b>Intrepid Insight Random Effects Meta-Analysis Summary RR</b> |             |      |          |           | <b>1.031</b> | <b>0.997</b> | <b>1.066</b> |

**Q Test Statistic = 109.5100704 I<sup>2</sup> 90.87%**

**Cochrane's Q Test for Homogeneity of Studies (Null Hypothesis: Studies are Homogenous)**

**P-Value = 6.69843E-19** → Since Studies fail Test for Homogeneity, Random Effects Meta-Analysis Yields Summary RR = 1.031 (0.997-1.066), which is statistically consistent with 1.000 (NO relationship)

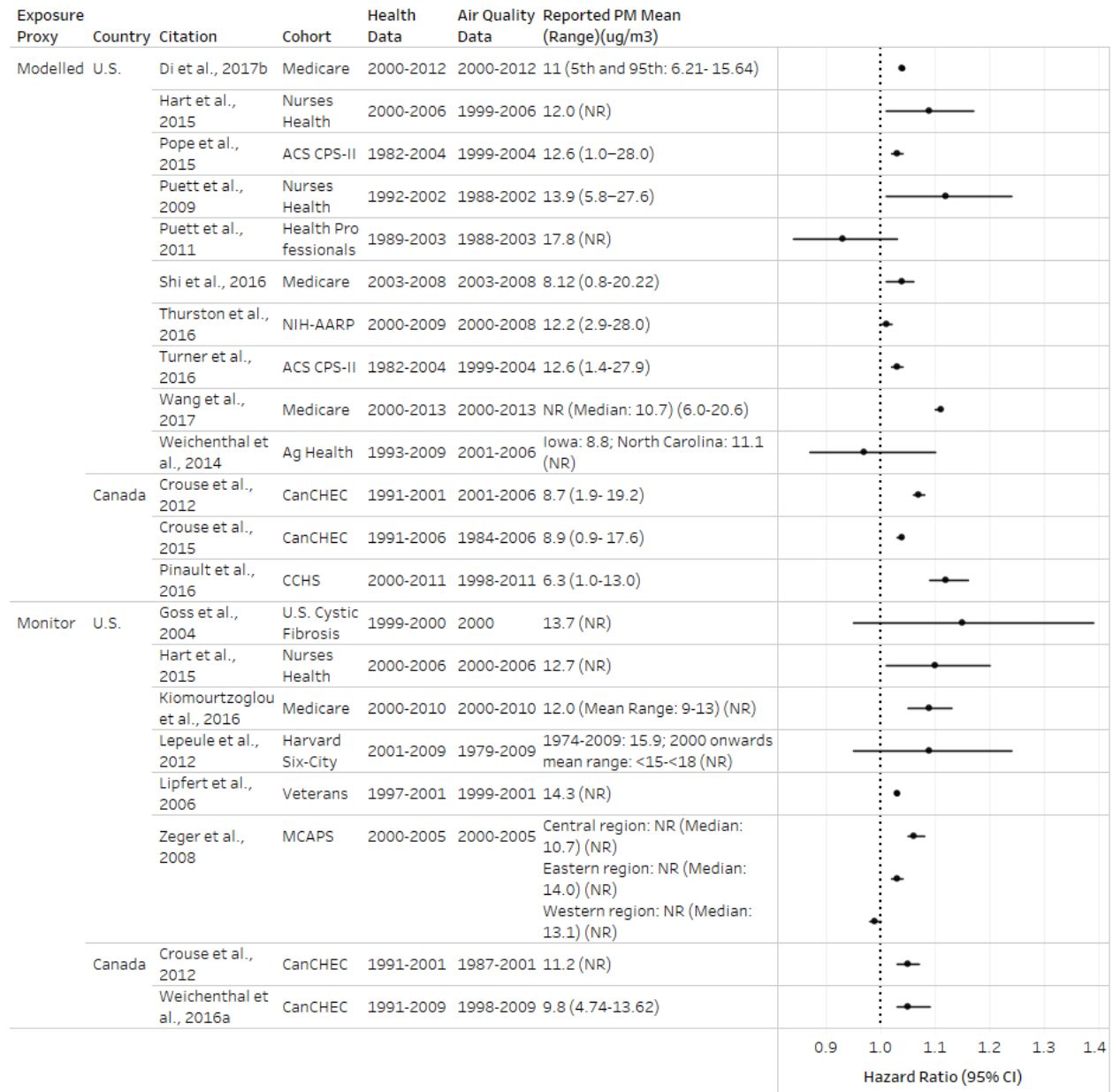
The original Zeger 2008 analysis of the Medicare cohort (MCAPS) was included in this meta-analysis rather than the Di 2017 analysis, because of the serious concerns about Di 2017 that I stated in my [October 12, 2017 NEJM letter](#). Dominici, the key author on both studies, does not explain how the overall RR increased from 1.044 in the Zeger 2008 analysis to 1.073 in the Di 2017 analysis. Di 2017 does not even cite Zeger 2008. If the Medicare cohort is removed from the meta-analysis because it does not properly control for confounders, II Table B4 shows that the Summary RR = 1.014 (0.973-1.057), which is also NO relationship.

Contrary to the evidence in the detailed II Table B3, the 2019 PM PA Figure 3-3 misrepresents the US evidence and inappropriately includes Canadian evidence. For instance, Figure 3-3 omits the null findings in the original Veterans Study (Lipfert 2000), as shown in II Table B3. In addition, Figure 3-3 includes results from the CPS II cohort twice (Pope 2015 and Turner 2016) and does not mention that my reanalysis found serious flaws in Pope 1995, HEI 2000, and HEI 2009. These flaws raise doubts about the validity of subsequent 'secret science' CPS II analyses by Pope and Turner. Figure 3-3 includes results from the Medicare cohort five times (Di 2017, Shi 2016, Wang 2017, Kiomourtzoglou 2016, Zeger 2008). There is no mention that the original Medicare study (Zeger 2008) is not consistent with the recent study (Di 2017). Figure 3-3 includes results from the Nurses Health Study twice (Puett 2009 and Hart 2015) and there is no mention that Puett 2009 and Puett 2011 omitted California subjects, who most likely had null findings. Inclusion of multiple hazard ratio (RR) results from the same cohort is inappropriate and gives the misleading impression that the RRs in most of the US cohorts are positive.

Inclusion in Figure 3-3 of results from Canadian studies is totally inappropriate because these positive Canadian RRs are not relevant to PM2.5 findings and policy assessment in the US. To show how the 2019 PM PA presented these results, Figure 3-3 on page 3-54 of the 2019 PM PA is reproduced below.

**2019 PM PA Figure 3-3. Epidemiologic studies examining associations between long-term PM2.5 exposures and [all-cause] mortality.**

All-cause mortality



## 2. 2019 PM PA Cites ‘Positive Authors’ and Omits ‘Null Authors’ and Their Criticism

Based on my extensive PM2.5 epidemiologic research and related knowledge since February 2002, I have strong evidence that the 2019 PM PA almost exclusively cites the research of ‘positive authors,’ investigators who publish positive relationships emphasizing the adverse health effects of PM2.5, and omits the ‘null authors,’ investigators who publish evidence of no health effects of PM2.5 and criticism of the adverse health effects findings. Prime evidence of this bias is my above critique of Figure 3-3 and the failure of the 2019 PM PA to address the serious issues raised in Cox 2017 and Cox 2019. In addition, the evidence of extreme bias toward ‘positive authors’ extends to the EPA 452/R-11-003 [April 2011 Policy Assessment for the Review of the Particulate Matter National Ambient Air Quality Standards](#) (2011 PM PA) and the annual publication of the American Lung Association “State of the Air” (ALA SOTA) (<https://www.lung.org/our-initiatives/healthy-air/sota/>). To document the magnitude of this bias, I tabulated the first author names of the publications cited in the 2019 PM PA, the 2011 PM PA, the 2019 ALA SOTA, and the 2011 ALA SOTA.

Table 1 shows the 2019 PM PA citations of 45 ‘positive authors’ separated into: Group 1) 21 authors associated with the Harvard TH Chan School of Public Health (HTHCSPH) and/or other northeastern universities; Group 2) 10 Canadian authors; and Group 3) 14 authors associated with the American Cancer Society or California universities. Group 1 authors are cited 291 times, Group 2 authors are cited 277 times, and Group 3 authors are cited 142 times. This is a grand total of 710 citations of ‘positive authors.’

Table 2 shows the 2019 PM PA citations of 50 authors who have published null findings and/or criticisms of the relationship between air pollution (particularly PM2.5) and mortality. These ‘null authors’ include CASAC members, CASAC consultants, four doctors representing 112 German pulmonary physicians (<https://www.dw.com/en/nitrogen-oxide-is-it-really-that-dangerous-lung-doctors-ask/a-47202076>), myself, and many other distinguished MDs and PhDs dating back more than 30 years. The 2019 PM PA cited these 50 ‘null authors’ a grand total of 10 times: 9 citations were to Cox 2019 and 1 citation was to Lipfert 2006. There were NO citations to 48 ‘null authors.’

Table 3 shows that 2019 PM PA cited the 7 CASAC members 9 times and cited the 12 CASAC consultants 8 times. All 9 of the CASAC member citations refer to the April 11, 2019 CASAC Review of the 2018 PM ISA submitted to EPA by Chair Tony Cox (Cox 2019).

In summary, the 2019 PM PA contained 710 ‘positive author’ and 10 ‘null author’ citations. The 2011 PM PA contained 529 ‘positive author’ citations and 8 ‘null author’ citations. The 2019 ALA SOTA contained 217 ‘positive author’ citations and 0 ‘null author’ citations. The 2011 ALA SOTA contained 165 ‘positive author’ citations and 0 ‘null author’ citations. In other words, both the EPA PM PA and the ALA SOTA are extremely biased toward ‘positive author’ findings and against ‘null author’ findings. Furthermore, the 2019 PM PA citation results in Table 1 reveal a dramatic increase since the 2011 PM PA in the citation of Group 2 Canadian authors and their Canadian studies. This shift toward Canadian authors and Canadian evidence is totally inappropriate because the 2019 PM PA is supposed to use the particulate matter evidence in the US as the basis for policy assessment in the US!

**Table 1. 'Positive Author' Citations in 2011 & 2019 EPA PM Policy Assessment and 2011 & 2019 ALA State of the Air October 17, 2019**

| 'Positive Authors' Who Publish and/or Promote Positive PM2.5 Death Findings          |                  |   |       | EPA PM PA | EPA PM PA | ALA SOTA | ALA SOTA |
|--|------------------|---|-------|-----------|-----------|----------|----------|
| First Name   | Last Name        | Institution (HTHCSPH training shown)            | State | 2019      | 2011      | 2019     | 2011     |
| <b>Group 1) Harvard TH Chan School of Public Health &amp; Other NE Investigators</b> |                  |   |       |           |           |          |          |
| Michelle L   | Bell             | Yale U (2002 PhD Enviro Eng JHU)                | CT    | 25        | 39        | 7        | 5        |
| Robert D   | Brook            | University of Michigan                          | MI    | 12        | 0         | 0        | 1        |
| Patricia F   | Coogan           | Boston University                               | MA    | 4         | 0         | 0        | 0        |
| Douglas W  | Dockery          | HTHCSPH (1979 ScD Env Health at HTHCSPH)        | MA    | 7         | 20        | 8        | 8        |
| Francine   | Dominici         | JHBSPH-->HTHCSPH                                | MA    | 27        | 29        | 12       | 6        |
| Jaime E  | Hart             | HTHCSPH (2008 ScD Env Health at HTHCSPH)        | MA    | 9         | 0         | 0        | 5        |
| Francine   | Laden            | HTHCSPH (1998 ScD Env Health at HTHCSPH)        | MA    | 14        | 18        | 5        | 6        |
| Joanne   | Lepeule          | HTHCSPH   | MA    | 14        | 0         | 3        | 0        |
| Morton   | Lippmann         | NYU   | NY    | 6         | 2         | 1        | 1        |
| Marianthi-Anna   | Kioumourtzoglou, | Columbia MSPH (2013 ScD Env Health Sci HTHCSPH) | NY    | 8         | 0         | 1        | 0        |
| Murray A   | Mittleman        | HTHCSPH (1994 DrPH HTHCSPH)                     | MA    | 4         | 2         | 4        | 5        |
| C Arden  | Pope III         | BYU (1992-1993 IPH Env Health at HTHCSPH)       | UT    | 20        | 27        | 11       | 13       |
| Robin C  | Puett            | University of Maryland SPH                      | MD    | 12        | 0         | 1        | 1        |
| Zev  | Ross             | ZevRoss Spacial Analysis                        | NY    | 6         | 0         | 0        | 0        |
| Jonathan M   | Samet            | JHBSPH->USC DPM->CO SPH (1977 MS Epi HTHCSPH)   | CO    | 28        | 88        | 9        | 5        |
| Joel D   | Schwartz         | US EPA-->HTHCSPH                                | MA    | 40        | 70        | 37       | 21       |
| Frank E  | Speizer          | HTHCSPH   | MA    | 3         | 3         | 3        | 3        |
| Helen H  | Suh              | HTHCSPH-->Tufts U (1993 ScD Env Health HTHCSPH) | MA    | 5         | 3         | 2        | 1        |
| George D   | Thurston         | NYU (1983 ScD Env Health Sci HTHCSPH)           | NY    | 16        | 9         | 6        | 5        |
| Annette  | Zanobetti        | HTHCSPH   | MA    | 24        | 51        | 18       | 10       |
| Scott L  | Zeger            | JHBSPH  | MD    | 7         | 15        | 4        | 4        |
| Total Citations  |                  |   |       | 291       | 376       | 132      | 100      |
| <b>Group 2) Canadian Investigators</b>   |                  |   |       |           |           |          |          |
| Jeffrey R  | Brook            | University of Toronto DLSPH                     | CN    | 13        | 5         | 1        | 1        |
| Richard T  | Burnett          | Health Canada, Ottawa                           | CN    | 38        | 33        | 7        | 5        |
| Daniel L   | Crouse           | University of New Brunswick, Fredericton        | CN    | 20        | 0         | 0        | 0        |
| Daniel   | Krewski          | University of Ottawa                            | CN    | 19        | 34        | 6        | 4        |
| Randall V  | Martin           | Dalhousie University, Halifax                   | CN    | 33        | 0         | 0        | 0        |
| Lauren   | Pinault          | Statistics Canada, Ottawa                       | CN    | 16        | 0         | 0        | 0        |
| Michelle L   | Turner           | University of Ottawa                            | CN    | 33        | 1         | 2        | 0        |
| Aaron  | van Donkelaar    | Dalhousie University, Halifax                   | CN    | 56        | 0         | 0        | 0        |
| Paul J   | Villeneuve       | University of Toronto SPH                       | CN    | 14        | 10        | 2        | 1        |
| Scott  | Weichenthal      | Health Canada, Ottawa                           | CN    | 35        | 0         | 0        | 0        |
| Total Citations  |                  |   |       | 277       | 83        | 18       | 11       |
| <b>Group 3) American Cancer Society and California Investigators</b>                 |                  |   |       |           |           |          |          |
| W Ryan   | Diver            | ACS National                                    | GA    | 13        | 0         | 1        | 0        |
| Susan M  | Gapstur          | ACS National                                    | GA    | 14        | 0         | 1        | 0        |
| Michael J  | Thun             | ACS National (1983 MS Epi HTHCSPH)              | GA    | 4         | 5         | 5        | 4        |
| Edward L   | Avol             | USC DPM   | CA    | 7         | 6         | 7        | 6        |
| Bernard S  | Beckerman        | UC Berkeley SPH                                 | CA    | 10        | 0         | 0        | 0        |
| Kiros T  | Berhane          | USC DPM   | CA    | 6         | 5         | 6        | 4        |
| W James  | Gauderman        | USC DPM   | CA    | 9         | 11        | 9        | 6        |
| Frank D  | Gilliland        | USC DPM   | CA    | 8         | 5         | 7        | 5        |
| Michael  | Jerrett          | CN-->USC DPM-->UCB SPH-->UCLA SPH               | CA    | 52        | 5         | 8        | 6        |
| Rob S  | McConnell        | USC DPM   | CA    | 7         | 9         | 7        | 5        |
| John M   | Peters           | USC DPM   | CA    | 3         | 11        | 5        | 7        |
| Edward B   | Rappaport        | USC DPM   | CA    | 4         | 4         | 3        | 3        |
| Duncan C   | Thomas           | USC DPM   | CA    | 1         | 5         | 4        | 4        |
| Hita   | Vora             | USC DPM   | CA    | 4         | 4         | 4        | 4        |
| Total Citations  |                  |   |       | 142       | 70        | 67       | 54       |
| Grand Total Citations  |                  |   |       | 710       | 529       | 217      | 165      |

**Table 2. 'Null Author' Citations in 2011 & 2019 EPA PM Policy Assessment and 2011 & 2019 ALA State of the Air October 17, 2019**

| 'Null Authors' Who Publish Null AP Findings and/or Criticize Postive AP Findings |            |  | EPA PM PA | EPA PM PA | ALA SOTA | ALA SOTA |      |
|--|------------|--|-----------|-----------|----------|----------|------|
| First Name   | Last Name  | Institution                                    | State     | 2019      | 2011     | 2019     | 2011 |
| <b>Published Critics of Air Pollution (including PM2.5) Causing Deaths</b>       |            |  |           |           |          |          |      |
| Jerome C   | Arnett     | Pulmonologist & CEI Retired                    | WV        | 0         | 0        | 0        | 0    |
| Daren  | Bakst      | Heritage Foundation & PM2.5 Working Group      | DC        | 0         | 0        | 0        | 0    |
| Lester   | Breslow    | CA Dept Public Health & UCLA SPH               | CA        | 0         | 0        | 0        | 0    |
| W Matt   | Briggs     | wmbriggs.com & Cornell U                       | NY        | 0         | 0        | 0        | 0    |
| William B  | Bunn       | Navistar International & U So Car              | SC        | 0         | 0        | 0        | 0    |
| Edward J   | Calabrese  | U Massachuets Amherst                          | MA        | 0         | 0        | 0        | 0    |
| Alan   | Carlin     | EPA Retired                                    | VA        | 0         | 0        | 0        | 0    |
| L Anthony  | Cox        | Cox Associates & U Colorado Denver             | CO        | 9         | 0        | 0        | 0    |
| John D   | Dunn       | Darnall Army Medical Center                    | TX        | 0         | 0        | 0        | 0    |
| Myron  | Ebell      | Competitive Enterprise Institute               | DC        | 0         | 0        | 0        | 0    |
| James E  | Enstrom    | UCLA Retired & Scientific Integrity Institute  | CA        | 0         | 0        | 0        | 0    |
| Gordon J   | Fulks      | Gordon Fulks and Associates & CO2 Coalition    | OR        | 0         | 0        | 0        | 0    |
| Michael  | Fumento    | AEI & Hudson & 'Polluted Science' Author       | DC        | 0         | 0        | 0        | 0    |
| John F   | Gamble     | Exxon Retired                                  | NJ        | 0         | 0        | 0        | 0    |
| Lawrence   | Garfinkel  | ACS National                                   | NY        | 0         | 0        | 0        | 0    |
| Julie E  | Goodman    | Gradient                                       | MA        | 0         | 0        | 0        | 0    |
| E Cuyler   | Hammond    | ACS National                                   | NY        | 0         | 0        | 0        | 0    |
| Martin   | Hetzel     | Represents 112 German Lung Specialists         | GER       | 0         | 0        | 0        | 0    |
| Thomas W   | Hesterberg | Navistar International & CTEH                  | IL        | 0         | 0        | 0        | 0    |
| Jon M  | Heuss      | Air Improvement Resource                       | MI        | 0         | 0        | 0        | 0    |
| John L   | Hoare      | AIR, Inc                                       | NZ        | 0         | 0        | 0        | 0    |
| Walter W   | Holland    | St Thomas's Hospital Medical School, London    | UK        | 0         | 0        | 0        | 0    |
| Michael  | Hunnicutt  | Texas Commission on Environmental Quality      | TX        | 0         | 0        | 0        | 0    |
| Geoffrey C   | Kabat      | Einstein CoM Retired & geoffreykabat.com       | NY        | 0         | 0        | 0        | 0    |
| Matthias   | Klingner   | Represents 112 German Lung Specialists         | GER       | 0         | 0        | 0        | 0    |
| Thomas   | Koch       | Represents 112 German Lung Specialists         | GER       | 0         | 0        | 0        | 0    |
| Dieter   | Köhler     | Represents 112 German Lung Specialists--Leader | GER       | 0         | 0        | 0        | 0    |
| Gary   | Koop       | U Leicester                                    | UK        | 0         | 0        | 0        | 0    |
| Goran  | Krstic     | Fraser Health                                  | CN        | 0         | 0        | 0        | 0    |
| Sabine S   | Lange      | Texas Commission on Environmental Quality      | TX        | 0         | 0        | 0        | 0    |
| Marlo  | Lewis      | Competitive Enterprise Institute               | DC        | 0         | 0        | 0        | 0    |
| Frederick W  | Lipfert    | Brookhaven Nat Lab Retired & Consultant        | NY        | 1         | 8        | 0        | 0    |
| Joseph L   | Lyon       | U Utah   | UT        | 0         | 0        | 0        | 0    |
| Roger O  | McClellan  | Toxicology Expert & Consultant                 | NM        | 0         | 0        | 0        | 0    |
| Henry I  | Miller     | Hoover Institution & Pacific Research Inst     | CA        | 0         | 0        | 0        | 0    |
| Steven J   | Milloy     | JunkScience.com & 'Scare Pollution' Author     | MD        | 0         | 0        | 0        | 0    |
| A Alan   | Moghissi   | George Mason U & Institute Reg Sci             | VA        | 0         | 0        | 0        | 0    |
| Suresh   | Moolgavkar | U Washington & Exponent                        | WA        | 0         | 0        | 0        | 0    |
| Daniel L   | Nebert     | U Cinninati Retired                            | OH        | 0         | 0        | 0        | 0    |
| Mikko  | Paunio     | U Helsinki                                     | FIN       | 0         | 0        | 0        | 0    |
| Douglas A  | Popken     | Cox Associates & U Colorado Denver             | CO        | 0         | 0        | 0        | 0    |
| Robert F   | Phalen     | UC Irvine                                      | CA        | 0         | 0        | 0        | 0    |
| Anne E   | Smith      | National Economic Research Associates          | DC        | 0         | 0        | 0        | 0    |
| Richard L  | Smith      | U North Carolina                               | NC        | 0         | 0        | 0        | 0    |
| Anthony V  | Swan       | Public Health Laboratory, London               | UK        | 0         | 0        | 0        | 0    |
| Lise   | Tole       | U Leicester                                    | UK        | 0         | 0        | 0        | 0    |
| Robert E   | Waller     | Department of Health, London                   | UK        | 0         | 0        | 0        | 0    |
| George T   | Wolff      | Air Improvement Resource                       | MI        | 0         | 0        | 0        | 0    |
| Ronald E   | Wyzga      | Electric Power Research Institute              | CA        | 0         | 0        | 0        | 0    |
| S Stanley  | Young      | NISS Retired & CGStat                          | NC        | 0         | 0        | 0        | 0    |
| Grand Total Citations  |            |  |           | 10        | 8        | 0        | 0    |

**Table 3. CASAC Member & Consultant Citations in 2011 & 2019 EPA PM Policy Assessment and 2011 & 2019 ALA State of the Air October 17, 2019**

| EPA CASAC Members and EPA CASAC Consultants Cited |           |  |       |  | EPA PM PA | EPA PM PA | ALA SOTA | ALA SOTA |
|---|-----------|--|-------|--|-----------|-----------|----------|----------|
| First Name  | Last Name | Institution                                | State |  | 2019      | 2011      | 2019     | 2011     |
| <b>EPA CASAC Members 2019</b>                     |           |  |       |  |           |           |          |          |
| L Anthony   | Cox       | Chair Cox Associates & U Colorado Denver * | CO    |  | 9         | 0         | 0        | 0        |
| James   | Boylan    | Georgia Department of Natural Resources    | GA    |  | 0         | 0         | 0        | 0        |
| Mark W  | Frampton  | U Rochester Medical Center                 | NY    |  | 0         | 0         | 0        | 0        |
| Ronald J  | Kendall   | Texas Tech University                      | TX    |  | 0         | 0         | 0        | 0        |
| Sabine  | Lange     | Texas Commission on Environmental Quality  | TX    |  | 0         | 0         | 0        | 0        |
| Corey M   | Masuca    | Jefferson County Department of Health      | AL    |  | 0         | 0         | 0        | 0        |
| Steven C  | Packham   | Utah Department of Environmental Quality   | UT    |  | 0         | 0         | 0        | 0        |
| Total Citations                                   |           |  |       |  | 9         | 0         | 0        | 0        |

\* All 9 citations refer to April 11, 2019 CASAC Review of the 2018 PM ISA submitted to EPA by Chair Tony Cox (Cox 2019)

| <b>EPA CASAC Consultants for PM Policy Assessment October 2019</b> |           |                                    |       |  | EPA PM PA | EPA PM PA | ALA SOTA | ALA SOTA |
|--|-----------|------------------------------------|-------|--|-----------|-----------|----------|----------|
| First Name   | Last Name | Institution                        | State |  | 2019      | 2011      | 2019     | 2011     |
| Constantin   | Aliferis  | U Minnesota                        | MN    |  | 0         | 0         | 0        | 0        |
| Brent  | Auverman  | Texas A&M U                        | TX    |  | 0         | 0         | 0        | 0        |
| Dan A  | Jaffe     | U Washington-Bothell               | WA    |  | 6         | 1         | 0        | 0        |
| John J   | Jansen    | Southern Company Services, Inc.    | AL    |  | 0         | 0         | 0        | 0        |
| Kristen  | Johnson   | Washington State U                 | WA    |  | 0         | 0         | 0        | 0        |
| Frederick W  | Lipfert   | Brookhaven Lab & Enviro Consultant | NY    |  | 1         | 8         | 0        | 0        |
| Joseph L   | Lyon      | U Utah                             | UT    |  | 0         | 0         | 0        | 0        |
| D Warner   | North     | NorthWorks & Stanford U            | CA    |  | 0         | 0         | 0        | 0        |
| David D  | Parrish   | NOAA & Consultant                  | CO    |  | 0         | 0         | 0        | 0        |
| Lorenz   | Rhomberg  | Gradient                           | MA    |  | 0         | 0         | 0        | 0        |
| Sonja  | Sax       | Ramboll                            | MA    |  | 0         | 0         | 0        | 0        |
| Duncan C   | Thomas    | U Southern California              | CA    |  | 1         | 5         | 4        | 4        |
| Total Citations  |           |                                    |       |  | 8         | 14        | 4        | 4        |

### 3. 2019 PM PA Authors Must Acknowledge and Address the PM2.5 Deaths Controversy

A very troubling aspect of the 2019 PM PA is the fact that the EPA Office of Air Quality Planning and Standards (OAQPS) authors refuse to acknowledge or address the intense scientific controversy that surrounded the establishment of the 1997 PM2.5 NAAQS and that continues unabated to this day. Since the specific authorship of the 2019 PM PA is not stated anywhere in the 457-page document, I requested the authorship information from the listed contact person, Dr. Scott Jenkins. Since he did not rapidly respond to my request, I looked up the 2011 PM PA ACKNOWLEDGMENTS, which state in part “This Policy Assessment is the product of the Office of Air Quality Planning and Standards (OAQPS). It has been developed as part of the Environmental Protection Agency’s (EPA) ongoing review of the national ambient air quality standards (NAAQS) for particulate matter (PM). The PM NAAQS review team has been led by Ms. Beth Hassett-Sipple. Dr. Karen Martin has managed the project. For the chapter on health effects associated with fine particle exposures and the primary PM2.5 standards, the principal authors include Ms. Beth Hassett-Sipple, Dr. Pradeep Rajan, and Dr. Zach Pekar. . . .”

Then I asked Dr. Zachary Pekar to provide me with the overall authorship information and state his specific role in writing 2019 PM PA Chapter 3 REVIEW OF THE PRIMARY STANDARDS FOR PM2.5. Since Dr. Pekar has not responded to me, I assume that he played a major role in writing Chapter 3, as he did in the 2011 PM PA “chapter on health effects associated with fine particle exposures and the primary PM2.5 standards.” It is important for CASAC members to know that Dr. Pekar was a lead EPA representative at the February 26, 2010 CARB Symposium “[Estimating Premature Deaths from Long-term Exposure to PM2.5.](#)” During 2008 and 2009 I was instrumental in providing the scientific impetus for this CARB Symposium, which is still fully documented on the CARB website. The CARB Symposium weblink includes the Agenda, the Panel, the individual PowerPoint presentations, the entire nine-hour webcast, the entire transcript, and an August 31, 2010 HEI follow-up analysis of the California ACS CPS II cohort data. The supporters of CARB position on PM2.5 premature deaths were Drs. Michael Jerrett, Daniel Krewski, Michael Lipsett, Melanie Marty, Suzanne Paulson, Arden Pope, Jonathan Samet, and George Thurston, as well as Zachary Pekar and Mary Ross of US EPA, and Daniel S. Greenbaum and Aaron Cohen of the Health Effects Institute (HEI). The critics of the CARB position were Drs. Thomas Hesterberg, Frederick Lipfert, Roger McClellan, Suresh Moolgavkar, Robert Phalen, and me.

Thus, Dr. Pekar was a first-hand witness to the intense ongoing PM2.5 deaths controversy almost ten years ago and since then he has been a primary author of PM2.5 health effects for the 2011 PM PA and the 2019 PM PA. Both of these policy assessments seriously misrepresent the research record and grossly exaggerate the adverse health effects of PM2.5 in the US. The misrepresentation is worse now because the 2019 PM PA does not even acknowledge the existence of or the importance of the proposed April 30, 2018 EPA Transparency Rule “[Strengthening Transparency in Regulatory Science.](#)” Dr. Pekar and the other PM PA authors uncritically accept the validity of the ‘positive author’ findings and ignore the ‘null author’ findings. They do not demonstrate understanding of the scientific method and the importance of transparency and reproducibility in scientific assessment of PM2.5 health effects. The CASAC members and the CASAC consultants must assess whether the evidence I have presented above represents falsification by OAQPS of the research record on PM2.5 deaths in the US.



#### 4. Enstrom Analyses of Data for Four Key US Cohorts Support the Need for EPA Transparency Rule

I provide strong support for use of the EPA Transparency Rule in finalizing the 2019 PM PA. I summarize below the four major cohorts for which I possess underlying data that is relevant to the PM2.5 NAAQS and the current Policy Assessment. The data that I possess has been kept strictly confidential and the identity of all subjects has been protected. My analyses of all four cohorts show NO relationship between PM2.5 and total mortality. NONE of the findings that I have published on three of these cohorts is cited in the 2019 PM PA.

##### A. 118,000 California Subjects in 1959 ACS CPS I (CA CPS I) Cohort with 1960-2002 Deaths

Since 1991 I have possessed the fully identified data for the 118,000 California subjects in the 1959 ACS Cancer Prevention Study (CA CPS I) cohort. With ACS approval, I have actively and passively followed these subjects from 1960 to 2002. My December 15, 2005 *Inhalation Toxicology* article "[Fine particulate air pollution and total mortality among elderly Californians, 1973-2002](#)" found NO relationship between PM2.5 and total mortality in the CA CPS I cohort from 1973 to 2002. A February 18, 2004 unpublished analysis "[Particulate Air Pollution and Mortality in 118,000 Californians, 1960-98](#)" by Dr. Frederick Lipfert and me found NO relationship between PM2.5 and total mortality in the CA CPS I cohort from 1960 to 1998. For instance, Table 3 shows the 10 variable-adjusted RR (95% CI) = 0.985 (0.962-1.009) among 85,978 CA CPS I subjects classified by 1979-1983 IPN PM2.5 level and followed for 1960-1972 mortality. The value shown refers to the relative risk (RR and 95% CI) of total mortality associated with an increase of 10  $\mu\text{g}/\text{m}^3$  in PM2.5. Table 6 shows the 10 variable-adjusted RR (95% CI) = 0.989 (0.946-1.034) among 105,724 CA CPS I subjects classified by 1961 self-described 'heavy air pollution' exposure (yes versus no) and followed for 1962-1972 mortality.

These null mortality findings in CA CPS I are consistent with the null 1960-1965 lung cancer mortality findings in the March 1980 *Preventive Medicine* article "[General Air Pollution and Cancer in the United States](#)" by Dr. E. Cuyler Hammond and Lawrence Garfinkel. Comparing subjects by level of total suspended particulates (TSP) among those not occupationally exposed: 8 cities with High TSP 130-180  $\mu\text{g}/\text{m}^3$  versus 14 cities with low TSP 35-99  $\mu\text{g}/\text{m}^3$  found RR  $\sim 0.89/1.10 = 0.81$  for lung cancer deaths during 1960-1965. Also, the observed lung cancer deaths were not increased in the high pollution California counties of Los Angeles, Orange, and Riverside. Since high air pollution levels during the 1960s were not related to mortality, it is implausible that the current low levels of air pollution are related to mortality.

##### B. 1,200,000 US subjects in 1982 ACS CPS II Cohort with 1982-1988 Deaths

Since 2016 I have possessed the original de-identified version of the underlying data for the 1,200,000 US subjects in the 1982 ACS Cancer Prevention Study (CPS II) cohort, which ACS followed for mortality from 1982 to 1988. The positive relationship between PM2.5 and total mortality in the CPS II cohort (Pope 1995) provided the primary epidemiologic evidence that was used to establish the 1997 PM2.5 NAAQS. My reanalysis presented in [Enstrom 2017](#) and [Enstrom 2018](#) provides unrefuted evidence that the positive relationship in Pope 1995 is not robust. Specifically, Table 3 of Enstrom 2018 shows substantial variation in the 1982-1988 relative risk (RR and 95% CI) of total mortality associated with PM2.5 defined in two different ways. For CPS II subjects residing in 47 US counties, RR = 1.081 (1.036-1.128) based on the 1979-1983 HEI PM2.5 values used in Pope 1995, but RR = 1.021 (0.984-1.058) based on the 1979-1983 IPN PM2.5 values used in Enstrom 2017 and Enstrom 2018. My reanalysis challenges the validity of the PM2.5 NAAQS and demonstrates the urgent need for the EPA Transparency Rule.

C. 160,000 California Subjects in 1995 NIH-AARP Diet and Health Study Cohort with 2000-2009 Deaths

Since 2012 I have possessed the de-identified public use file for the 160,000 California subjects in the [NIH-AARP Diet and Health Study](#) cohort, including 1995-2010 total mortality follow-up data. In 2011 I applied for full NIH-AARP database, but I was only able to obtain the California subjects because Dr. George Thurston applied for and received the full database in 2009. Dr. Thurston demonstrates the variation in PM2.5 mortality risk based on his own analyses of this cohort. His August 7-11, 2011 IEA World Congress of Epidemiology Abstract P1-355 [LONG-TERM PM2.5 AIR POLLUTION EXPOSURE AND MORTALITY AMONG CALIFORNIA RESIDENTS IN THE NIH-AARP COHORT](#) shows a strongly positive RR = 1.09 (1.05-1.12) for total mortality in California. However, his [2016 EHP article](#) shows the null RR = 1.02 (0.99-1.04) in Table 3 and the null RR = 1.017 (0.990-1.040) in Figure 3. The null 2016 RRs are in good agreement with my null RR = 1.001 (0.949-1.055) for total mortality in California, as shown in Enstrom 2017 Table B1. The NIH-AARP Diet and Health Study is a great example of how to facilitate independent analysis of epidemiologic cohort data without violating subject confidentiality. This is further evidence in support of the EPA Transparency Rule.

D. 8,096 Subjects in the Harvard Six Cities Study with 1989-2009 Deaths

Following the [August 1, 2013 House Science Committee Subpoena](#), I received a fully de-identified version of the 1974 Harvard Six Cities Study (H6CS) cohort data for the subpoenaed [July 2012 EHP article by Lepeule, Laden, Dockery, and Schwartz](#) (Lepeule 2012). This is a SAS data file in the Anderson-Gill format named "[Lepeule2012\\_data\\_0713.sas7bdat](#)." Six key variables for ten sample records are:

| cityc | rstrata | ptime | ypm2_5 | y | pm2_5b | deadt |
|-------|---------|-------|--------|---|--------|-------|
|-------|---------|-------|--------|---|--------|-------|

The first five records are:

|     |    |   |      |      |   |
|-----|----|---|------|------|---|
| STL | 4  | 1 | 25.2 | 25.2 | 0 |
| STU | 4  | 1 | 39.5 | 39.5 | 0 |
| STL | 17 | 1 | 25.2 | 25.2 | 0 |
| STU | 17 | 1 | 39.5 | 39.5 | 0 |
| STL | 20 | 1 | 25.2 | 25.2 | 0 |

Last five records are:

|     |       |          |      |      |   |
|-----|-------|----------|------|------|---|
| TOP | 25615 | 1        | 9.8  | 12.3 | 0 |
| TOP | 25620 | 0.058864 | 11.2 | 11.7 | 1 |
| TOP | 25620 | 1        | 11.2 | 11.7 | 0 |
| TOP | 25632 | 1        | 10   | 11.6 | 0 |
| TOP | 25643 | 0.640657 | 8.7  | 12.1 | 0 |

The October 11, 2013 [Enstrom Tang Analysis of Lepeule2012\\_data\\_0713.sas7bdat](#) was able to exactly reproduce several tables in Lepeule 2012. However, since 1974-1988 death information was omitted from the SAS file, the tables involving deaths could not be fully reproduced. Also, it was not possible to reproduce the findings in the seminal article [Dockery 1993](#). In any case, this de-identified data demonstrates that NO subject confidentiality has been violated, contrary to unjustified claims by opponents of the EPA Transparency Rule. CASAC members should request this H6CS data from the Lepeule 2012 authors and/or EPA in order to confirm the 2013 Enstrom Tang Analysis and to confirm that NO subject confidentiality has been violated in the entire file. This would provide further support for the EPA Transparency Rule. Finally, it is important to realize that the weak relationship between PM2.5 and mortality in the tiny H6CS cohort does not justify the PM2.5 NAAQS. Indeed, Laden 2006 Table 2 and Lepeule 2012 Table 2 show NO relationship between PM2.5 and total deaths since 1990.

## 5. 2019 PM PA Must be Revised as per CASAC Review and Criticism by Enstrom and Others

In summary, the 2019 PM PA provides no evidence that supports changing the PM2.5 NAAQS. To the contrary, the evidence I have presented in the four sections above support the need to reassess the entire scientific basis for the PM2.5 NAAQS. Since the 2011 PM PA went through three drafts in September 2009, March 2010, and June 2010 before being finalized in April 2011, CASAC should recommend that a similar process be followed for the 2019 PM PA. All criticism of the September 2019 PM PA by the CASAC members and the CASAC consultants, as well as the criticism by me and others, must be addressed in the second draft of the 2019 PM PA.

Despite over 25 years of claims about the adverse health effects of PM2.5, there is still NO established etiologic/biologic mechanism for PM2.5 to cause premature death. The average amount of PM2.5 inhaled by each person in the US is infinitesimal: about 50 micrograms ( $\mu\text{g}$ ) per day, about 0.02 grams per year, and about 1.5 grams during an 80-year lifespan. All the PM2.5 epidemiologic cohort study results are subject to the ecological fallacy because there are NO direct measurements of actual PM2.5 exposure among the cohort subjects. Also, the cohort study results are subject to uncontrolled confounding variables, such as, co-pollutants. The small positive relative risks ( $0 < \text{RR} \leq 1.15$ ) reported in the US cohort studies do not satisfy the established Hill criteria that are used to establish a causal epidemiologic relationship. Indeed, based on the null evidence I have described above for the CA CPS I, CPS II, NIH AARP, and H6CS cohorts, I believe that all of the results for the US studies, if transparently and objectively analyzed, are consistent with NO relationship between PM2.5 and total mortality. In any case, the objective meta-analysis of the published results for nine major US cohorts in II Table B3 above found a summary RR that is consistent with NO relationship between PM2.5 and total mortality.

To reinforce the above points, please examine three major critiques of the claim that PM2.5 causes premature deaths: the 2016 Steven J. Milloy book "[Scare Pollution: Why and How to Fix the EPA](#)," my July 20, 2019 DDP lecture "[The PM2.5 Deaths Controversy: Combating Pseudoscientists](#)," and the September 18, 2019 William Matt Briggs video "[The Epidemiologist Fallacy Exposed](#)."

The EPA OAQPS authors have a special obligation to increase the transparency, objectivity, and scientific integrity of the 2019 PM PA, especially regarding Chapter 3. They must properly cite the results and criticisms of the 'null authors' and they must not uncritically accept and cite the findings of the 'positive authors.' They must show support for the EPA Transparency Rule by releasing the August 1, 2013 House Science Committee Subpoena H6CS data that they must possess. The CASAC members and CASAC consultants need to examine this H6CS data in order to independently assess the H6CS findings and confirm that this de-identified data does not violate subject confidentiality. If the EPA OAQPS authors will not release this H6CS data, I will release the H6CS data that I possess to the CASAC members. Also, the EPA OAQPS must encourage the ACS investigators to release a de-identified version of the CPS II data that has been used as the basis for the CPS II findings cited in the 2019 PM PA. If the ACS investigators continue to refuse to release this data, then I will work with the CASAC members in a full analysis of the original CPS II data that I used in Enstrom 2017 and Enstrom 2018.

The evidence and criticism above provide a very strong basis for reexamining the entire PM2.5 NAAQS and I strongly encourage the CASAC members and CASAC consultants to undertake this reexamination.